FOOD FOR PROGRESS

SAFETI PROJECT

(SAFE AQUA FARMING FOR ECONOMIC AND TRADE IMPROVEMENT)

Baseline Survey

of farmers and other actors in the shrimp & prawn value chain

MAY 2017

Conducted By

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ACRONYMS

A/C holder	Account Holder
BDT	Bangladeshi Taka
BFFEA	Bangladesh Frozen Food Exporters Association
BFRI	Bangladesh Fisheries Research Institute
CBO	Community Based Organization
CP	Charoen Pokphand
CPL	Consiglieri Private Limited
DEO	Data Entry Operators
DoF	Department of Fisheries
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FGD	Focused Group Discussion
FIQC	Fish Inspection and Quality Control
GHP	Good Handling Practice
GoB	Government of Bangladesh
HACCP	Hazard Analysis and Critical Control Points
HH	High Health
kg	Kilogram
KII	Key Informant Interview
LoP	Life of Project
MFI	Micro Financial Institutions
ml	Milliliter
mt	Metric Tons
NGO	Non-Governmental Organization
PCR	Polymerase Chain Reaction
pH	positive hydrogen
PL	Post Larvae
PMP	Performance Monitoring Plan
QC	Quality control
RFP	Request For Proposal
RoI	Return on Investment
SAFETI	Safe Aqua Farming for Economic and Trade Improvement
SPF	Specific Pathogen Free
USAID	United States Agency for International Development
USD	United States Dollar
USDA	United States Department of Agriculture
WF	WorldFish
WSSV	White Spot Syndrome Virus

EXECUTIVE SUMMARY

Bangladesh has shown remarkable progress in finfish aquaculture over the past 15 years, with an average growth rate of 8.2 percent per annum from 2000-2015, reaching production of 1.83 million tons in 2015 (Department of Fisheries data[1]). Bangladesh was ranked fifth in world farmed finfish production in 2014 (Food and Agriculture Organization of the United Nations [FAO] data[2]).

However, farmed shrimp and prawn[3] production reached only a reported 0.125 million tons in 2015, from a farm area of 275,583 ha. Productivity remains very low in world terms at an average of 457 kg/ha.yr (DoF 2014-15) (compared with for instance Thailand 4.3 t/ha.yr [0.3 million t from 70,000 ha]; India 2.6 t/ha.yr [0.4 million t from 150,000 ha] [FAO]). Bangladesh annual shrimp and prawn exports have declined over the past 15 years to a level of only 44,278 mt in 2014-15 (DoF). The baseline study has confirmed that the main contributing factors to the low productivity in Bangladesh farms are the lack of disease free seed, a lack of knowledge among farmers of modern production technologies and a shortage of appropriate financing mechanisms to support infrastructure development.

Bangladesh has the potential to become a major global producer and exporter of shrimp and prawns. The country has brackish water pond resources in excess of 275,000 ha (nearly twice the area India has, yet India produces three times as much shrimp and prawns), and large areas of freshwater ponds, rice fields and natural water bodies suitable for the supplementary production of freshwater prawns. Bangladesh benefits from favorable climatic, soil and salinity conditions that would allow for two or more shrimp and/or prawn crops per year. Most of the country's existing shrimp and prawn farming ponds are in the south-west of the country, in the Districts of Satkhira (75,867 ha), Bagerhat (72,684 ha), Khulna (58,367 ha) and Jessore (11,234 ha). In the east of the country in Cox's Bazar District there are a further 44,465 ha. These five Districts contain 95.3% of the total shrimp and prawn farming ponds of the country[1]. Cox's Bazar District is also where most of the shrimp hatcheries producing seed to stock the farms, are located.

The USDA funded "Safe Aqua Farming for Economic and Trade Improvement" project (SAFETI) being implemented by Winrock International from October 2016 – September 2021 will be working in those five Districts and aims to support the Bangladesh government's efforts to achieve the unrealized economic potential of shrimp and prawn farming. The project has two objectives:

1. Increase agricultural productivity by improving production and management of hatcheries and farms in the shrimp and prawn value chains to contribute to both improved incomes, food quality and safety, as well as to improve livelihoods and environmental sustainability in the Bangladesh prawn and shrimp industry.

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[1] Fisheries Resources Survey System (FRSS) 2016. Fisheries Statistical Report of Bangladesh; FRSS Department of Fisheries, Bangladesh; Volume 32: 57pp.

[2] FAO 2011-2017: Fisheries and aquaculture software. FishStatJ - software for fishery statistical time series. FAO Fisheries and Aquaculture Department [online]. Rome.

[3] Note: the terms 'shrimp' and 'prawn' differ in their usage around the world without a consistent biological basis. For the purposes of the project the customary USA usage is followed where the species grown in sea water or brackishwater are called 'shrimp' and the species grown in fresh water are called 'prawn'. Two main species are grown in Bangladesh: a 'shrimp', the Black Tiger (*Penaeus monodon*) known in Bangla as 'bagda' and a 'prawn', the Giant Freshwater Prawn (*Macrobrachium rosenbergii*) known in Bangla as 'golda'.

2. Expand trade of agricultural products by improving handling and sanitary controls, reducing unnecessary layers in the value chain, promoting extension services, and building the capacity of trade associations and government trade promotion bureaus.

The SAFETI project will be evaluated against 18 indicators (see page 2). As a key initial step in the project's monitoring and evaluation plan, a baseline study was carried out in March and April 2017 in all five project target districts to establish the pre-activity values of these indicators and to check the assumptions underlining the project design. The Dhaka based company Consiglieri Private Limited was selected to carry out the study. The study collected baseline data, (including on current practices, business performance, knowledge, challenges and constraints) from different shrimp and prawn value chain actors. 400 farmers of shrimp and prawn were the central focus of the study, but it also extended to a range of other sector actors involved in the value chain, 75 in total: prawn hatchery owners (4), shrimp hatchery owners (6), sellers of feed and other inputs (10), owners of shrimp nurseries (pre-growing seed to a larger size before stocking in the main ponds) (8), faria (small traders buying shrimp from farmers and selling on) (7), aratdars (auctioneers of harvested shrimp) (7), agents (financing post-harvest actors and controlling product flows) (5), processors (5), feed manufacturers (2), Department of Fisheries senior staff (7), representatives of trade associations (2) and overseas buyers (2). A separate survey was performed by SAFETI staff of 9 intensive shrimp farmers (a sub-sector of the industry comprising about 200 farmers operating 1000 ha of ponds at a high intensity of production, with large capital investment and infrastructure. These farms produce 3-8 t/ha.yr).

During data cleaning, data on 3 shrimp farmers and 1 prawn farmer were discarded as outliers (two shrimp farmers in Cox's Bazar with farm areas of 405 ha and 486 ha – making them extrodinarily large land owners); one shrimp farmer in Khulna with a production of 4.86 t/ha classifying him as an intensive farmer; and one prawn farmer in Satkhira with a farm area of 24 ha, when the next largest farm area of all the other 98 prawn farmers was only 2.9 ha).

The average age of the shrimp farmer respondents was 43 years (ranging 16-72), and of the prawn farmers 45 years (ranging from 25-73). Household (HH) size ranged from 5 to 6 members for shrimp farmers and 5-8 for prawn farmers. More detailed information about these aspects is provided in Annex 2 (Section 2.2).

On average, the 298 shrimp farmers surveyed and included, operated two ponds, though some had as many as 5, with an average total pond and dyke area per farmer of 2.1 ha in Khulna District, 2.2 ha in Bagerhat District, 1.4 ha in Satkhira District and 19.8 ha in Cox's Bazar District.

This difference in average farm size between Khulna, Bagerhat and Satkhira Districts in the south-west and Cox's Bazar District in the east of the country merits some explanation. The structure of the shrimp sector in Chokaria Upazilla of Cox's Bazar District where the study was made is different from the main shrimp farming areas of the greater Khulna area - in terms of ownership as well as production methods. In the Khulna area farmers were originally subsistence rice farmers, unlike in Cox's Bazar where due to historical reasons large blocks of government land were leased to individuals specifically for shrimp farming, and these in many cases are large absentee leaseholders. In the south-west of the Khulna region, land holdings are smaller though owners in many cases lease additional pond areas from neighbors.

There is little freshwater prawn farming activity in Cox's Bazar and the East-West difference in ownership patterns is not seen in the prawn sector. The 98 prawn farmers surveyed and included, operated an average of two ponds (and as many as 5) and with average areas of 0.76 ha in

Khulna District, 0.67 ha in Bagerhat District, 0.81 ha in Satkhira District and 0.87 ha in Jessore District.

An interesting finding of the study was the increasing amount of leasing (called leasing-in here) that is occurring. Shrimp farmers in Satkhira, Bagerhat and Khulna typically have their own ponds/ghers but also lease-in (48% of farmers in Khulna lease in; 47% in Bagerhat and 63% in Satkhira). In Cox's Bazar ownership is less common and 100% of those farmers interviewed leased-in. For prawn farmers, most both own and lease-in ponds (23% of prawn farmers in Khulna lease in; 63% in Bagerhat, 57% in Jessore and 78% in Satkhira) Most leases are single, not joint and are for 2 to 5 years.

The data collection work was designed around the results frameworks of the SAFETI project. There are two of these frameworks, one dealing with agricultural productivity and the other with expanded trade of agricultural products. Figures 1 and 2 in the report illustrate the envisaged interventions, expected knowledge/skill/capacity level changes, expected practice and behavior level changes, expected enterprise and systemic level changes, and finally, expected project impacts. Detailed analytical framework and the key questions framed for each of the value chain actors are presented in Annex 1 (Table: 1).

Major Findings

Perhaps the most instructive finding of the baseline study is that low production volume is the key issue affecting the entire shrimp/prawn sector, including the profitability of farmers and of many upstream and downstream actors; and it is holding back improvements in post-harvest handling, product quality and export value.

The low overall production affecting the sector is in turn due to the low productivity per ha: the baseline study found productivity levels of around 300 kg/ha.yr of prawn and shrimp. This compares with for instance 4.3 t/ha.yr in Thailand and 2.6 t/ha.yr in India [FAO] [2]). Bangladesh has a vast area producing well below its potential due to poor seed quality and poor farming technologies.

The annual net profits made by the shrimp farmers surveyed averaged USD $732 per ha in Khulna, USD $792 per ha in Bagerhat, USD $980 per ha in Satkhira and USD $532 per ha in Cox's Bazar. These included all the net profits from the operation of their ponds, with shrimp, prawn, fish and in some cases vegetables grown on dykes making a contribution. These profits compare with levels around USD $5-10,000 per ha.yr in neighboring countries such as Thailand, or USD $3-5000 per ha.yr on average in India.

The prawn farmers surveyed reported annual net profits of USD $2664 per ha in Khulna, USD $2667 per ha in Bagerhat, USD $1941 per ha in Jessore and USD $2603 per ha in Satkhira, again including all the pond operations, shrimp prawn, fish and vegetables.

Exporters, processors and overseas buyers comment that the black tiger shrimp grown in Bangladesh - *P. monodon* - is favored on world markets over the species that dominates world production – the white-legged shrimp *P. vannamei.* White-legged shrimp now accounts for 80% of world farmed shrimp production, has lower production costs, but is considered in many markets as less tasty than the black tiger. However, the image of Bangladesh shrimp on the world market is one of low quality and with a risk of adulteration, including with antibiotic residues. As a result, Bangladesh shrimp (and freshwater prawn) competes on price, instead of on quality, a missed opportunity for the country.

Increasing productivity and product volumes will not only improve farmer incomes but will also make a major contribution to addressing the quality issue. This is because it will make the use of ice and better handling practices more economically viable, and encourage a shortening of the post-harvest delivery chain, which at present involves several layers of middlemen. Within these layers is where most of the damaging adulteration of the product currently takes place – including malpractices such as injection with gelatin and soaking in water to increase weight.

The underlying assumptions of the project design and the relevance of the planned activities are supported by the findings of the baseline study. Modifications to two activities are recommended (see below).

Main Findings from the Farmers' Survey

The survey was conducted with shrimp and prawn farmers to collect quantitative and some qualitative data on their production and management practices, performance, knowledge level, challenges and risks they face. A total of 400 semi-structured interviews were conducted. To complement quantitative findings from the survey, nine Focus Group Discussion (FGDs) were conducted with 90 farmers to know about their collective business approach, their attitude towards different technologies, value chain actors, products and services, major market constraints, challenges and risks they face. Three of these FGDs were conducted with women farmers to better gauge the gender dynamics in the shrimp value chain. Key Informant Interviews (KIIs) were also conducted with other value chain actors. The research tools used for data collection, the questions asked and the findings are summarized in this report and detailed in Annex 2.

Bangladeshi farmers in general, while aware of some aspects of modern shrimp and prawn farming technologies, seldom follow the key, simple steps needed to ensure good production. Poor management practices are widespread.

The baseline survey identified the following priorities, which are common across all five Districts:

1. A need for high quality, disease-free seed.
2. A need for improved pond infrastructure - minimum 1 m depth and access to quality water.
3. A need for improved methods of pond preparation and management, and maintenance of biosecurity.
4. A need for access to suitable financing (of an amount, and with an interest rate and repayment schedule that is workable for farmers. Most small farmers reported having no access to private bank or MFI credit. Most MFI loans currently available have too low a ceiling, and a repayment schedule that starts too soon for farmers who have to wait 3-4 months before they receive any sales revenue).
5. A need for improvement in post-harvest handling between the farmer and the auction center or depot (In particular, few farmers use ice), as well as improved traceability systems.

A new finding from the baseline survey was that while the use of ice has been a part of recommendations of government and a number of projects, downstream buyers (depots/arats) discourage its use, because of a fear of adulteration of the product and a misunderstanding of the factors involved. SAFETI will work to address this through training of downstream buyers and of beneficiary farmers.

Surveys of Other Sector Actors

The baseline survey achieved a comprehensive coverage of other sector actors. These actors identified major constraints as discussed below:

Shrimp hatcheries

Main constraints: inability to access disease free (High Health- Specific Pathogen Free [SPF]) broodstock or nauplii, technical knowledge of staff; post-larvae (PL) supply thought to exceed market demand; poor laboratory services support (disease/Polymerase Chain Reaction (PCR) screening etc.); a lack of phytoplankton seed cultures.

Prawn hatcheries
Main constraints: unexplained larval mortalities that have led to closure of most Bangladesh hatcheries over the last 5 years. Lack of access to disease free or (SPF) broodstock.

Commercial nurseries
Main constraints: low demand for juveniles from farmers; lack of training on proper PL rearing and hygiene maintenance; degradation of quality of locally available water.

Local feed manufacturers
Main constraints: the local market for shrimp feeds (<10,000 t) and prawn feeds (<25,000 tons) is too small to justify large scale investment in production. Prawn feed is currently being adequately supplied by national mills and shrimp feed by imports. (In addition, several of the world's largest shrimp feed producers [CP-Thailand, Tongwei-China, Spectra-Hexa Bangladesh-Thai, New Hope-China and others], have feed plants in Bangladesh. They are not producing shrimp feeds as of yet but have the technical capacity to produce high quality feeds if the market grows.)

Input dealers/retailers
Main constraints: lack of knowledge by farmers on good feed management practices, pond preparation, chemical usage and disease management; no specialized credit scheme for shrimp feed and input supply businesses; limited support from government extension bodies and research institutes to prevent frequent disease losses.

Faria/small trader
Main constraints: allegations that farias are involved in malpractices to increase shrimp/prawn weight (such as 'pushing' [injecting gelatin] and soaking in ice-water).

Arats/auction centers
Main constraints: lack of product supply; inadequate knowledge of Good Handling Practice (GHP) - Arats discouraging farmers from using ice; lack of access to appropriate financial products.

Depots
Main constraints: lack of product supply; delay in payments by account holders; employees do not have training on FIQC and how to ensure quality standards; ice plants in some locations cannot supply enough ice during peak seasons; and, like arats, depots discourage upstream suppliers from using ice.

Account holders/Agents
Main constraint: lack of product supply

Processors
Main constraint: lack of product supply

Trade Associations: Bangladesh Frozen Food Exporters' Association
Main constraints: low productivity at farmer level; lack of traceability due to small scale of farming; lack of continuous cold chain during transport and storage; malpractice such as 'pushing' and soaking.

Trade Associations: Shrimp PL Traders Association-Satkhira

Main constraints: quality of PL and concerns about disease; low price of PL discourages hatcheries from striving for quality improvement; lack of PL testing facilities before marketing; low awareness about disease prevention; Government research and testing facilities not able to provide effective and prompt support; lax monitoring allows low quality PL to enter the market.

Buyers/buyer representatives
Main constraints: low productivity; cold chain not maintained at all times leading to quality deterioration; malpractice still prevalent in the value chain ('pushing', soaking) but less than before- overseas buyers react negatively when malpractice found - including discontinuation of purchasing; Bangladeshi shrimp/prawn losing out to price competition from white shrimp (*P. vannamei*) in the international market.

Department of Fisheries
Main constraints: poor knowledge by farmers of shrimp/prawn culture practice, lack of modern technologies on feed, water and nutrition management; poor farm infrastructure in extensive farms - inadequate water depth, water supply and drainage systems are poor and often silted up; value chain with too many middlemen and actors; mis-use of chemicals and medicines in hatcheries and in farm production; weak cold chain maintenance throughout the value chain; malpractice by some middlemen to increase weight of shrimp and prawn; outbreak of viral, bacterial diseases at different stages of production; many DoF positions in shrimp/prawn producing areas are vacant; insufficient technical human resources; insufficient logistic and testing equipment at DoF field offices; weak cooperation and contact among the public and private actors involved with shrimp/prawn sector development.

Recommendations on Changes to Project Activities as a Result of the Baseline Study Findings

SAFETI has 11 planned activities:

Activity 1: Inputs: Support Development of agro-dealers and/or other input suppliers
Activity 2: Financial Services: Facilitate agricultural lending
Activity 3: Training: Improved aquaculture production technologies
Activity 4: Capacity Building: for government
Activity 5: Capacity Building: Promote improved policy and regulatory framework
Activity 6: Training & Facilitation: Sanitary and phytosanitary standards
Activity 7: Training: Post-harvest Handling
Activity 8: Infrastructure: Post-harvest Handling and Storage
Activity 9: Training: Improved Marketing and Branding
Activity 10: Market Access: Facilitate Buyer-Seller Relationships
Activity 11: Capacity Building: Trade Associations

The baseline findings emphasize the prime importance of Activities 1, 2 and 3: supply of clean disease-free seed (included in Activity 1), improved pond infrastructure and production technologies (Activity 3) and the finance to fund the changes (Activity 2). These three are identified as key to promoting an increase in productivity, production and exports. Activities 4 through 11 are similarly confirmed as appropriate to address the aims of Objective 2: in particular, to expand trade, improve post-harvest handling and build the capacity of trade associations and government.

The baseline findings suggest the following two activities should, however, be modified:

Activity 1: Inputs: Develop Agro-dealers and/or Other Input Suppliers

Activity 1 envisaged work not only on seed and other inputs (which remain important) but also work on feed: the Work Plan approved January 2017 proposed that because "*National feeds currently are of poor quality, including regarding formulation and physical properties"* the project would *"provide technical assistance to leading Bangladesh feed mills on feed formulation and manufacturing ..."*

The baseline survey has established that national feed manufacturers are producing golda (prawn) and fish feeds of acceptable quality, and that the current market for bagda (shrimp) feeds is being well supplied by imports – national manufacturers see the shrimp feed market as currently being too small for them to enter the business in competition with imported feeds. Access to good quality feed is thus not currently a constraint in Bangladesh. It is proposed therefore that the project does not proceed with *"provid(ing) technical assistance to leading Bangladesh feed mills on feed formulation and manufacturing ..."* and that we cut the activities:

- *1.16 Conduct detailed chemical/nutritional analysis of feeds currently available on the local market;*
- *1.17 Conduct Technical Needs Assessment (TNA) of feed manufacturers;*
- *1.18 Carry out economic analysis and evaluation of inputs for small-scale feed production;*
- *1.19 Based on the TNA, identify and support cooperating feed mills: on how to upgrade systems and feed quality and support more efficient production of higher quality shrimp and prawn feeds;*
- *1.20 Encourage the use of soy and soy products including Soya Protein Concentrate to reduce the amount of fish meal and oil in shrimp and other aquatic animal diets;*
- *1.22 ...provide technical support to selected feed manufacturers in formulation and processing...*

Activity 8: Infrastructure: Post-harvest Handling and Storage

The Work Plan approved January 2017 proposed that "*SAFETI will embed improved cold chain equipment at critical collection centers and marketing junctions of targeted value chains through the use of improved aggregation depots and methods and procedures in establishing cold chain; and depending on budget availability, by upgrading cold chain equipment at selected depots, landing centers, and auction sites along the aquaculture value chain.*

SAFETI will promote linkages to credit for co-investment and credit options. Cold chain infrastructure will be promoted using a three-pronged approach that will increase understanding of the purpose of cold chains, identify appropriate innovative technologies, and introduce to beneficiaries cost-benefit analysis."

The baseline study has established that there is considerable overcapacity in the processing sector and no immediate shortage of refrigeration and product handling infrastructure or equipment. Total processing capacity was estimated by the Bangladesh Frozen Food Exporters' Association in 2016 at 350,000 mt per year, and the plants are running at less than 30-40% capacity. Data on cold storage facilities are not separately available, but it is estimated that, given exports of less than 45,000 mt per year the use of existing national cold storage capacity is limited. It is therefore proposed that this activity be reduced to provision of small-scale equipment such as insulated boxes and handling equipment to direct project beneficiaries. This reduction will be subject to further review during project implementation, and modified should it become clear there is a need for additional cold storage capacity.

Recommendations on Changes to Project Indicators as a Result of the Baseline Study Findings

The SAFETI project will be evaluated against 18 indicators (see page 2). In the light of the baseline study findings of no need for increased cold storage capacity (see paragraph above) it is recommended *Indicator 6; FFPr Sl-11 Total increase in installed storage capacity (dry or cold storage) as a result of USDA assistance* - which sets a target of 1,612 cu.m. be deleted.

The following report details the research design, data collection, findings, analysis and recommendations for the SAFETI project. Annexes provide additional details for the questionnaires, list of interviews held, and other supporting documentation.

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THE BASELINE STUDY

1.1 Background and Objectives of the Study

Bangladesh has shown remarkable progress in finfish aquaculture over the last 15 years, with an average growth rate of 8.2 percent per annum from 2000-2015, reaching production of 1.83 million tons in 2015 (Department of Fisheries [DoF] data[1]). Bangladesh was ranked fifth in world farmed finfish production in 2014 (Food and Agriculture Organization of the United Nations [FAO] data[2]).

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Most of the country's existing shrimp and prawn farming ponds are in the south-west of the country, in the Districts of Satkhira (75,867 ha), Bagerhat (72,684 ha), Khulna (58,367 ha) and Jessore (11,234 ha). In the east of the country in Cox's Bazar District there are a further 44,465 ha. These five Districts contain 95.3% of the total shrimp and prawn farming ponds of the country[1]. Cox's Bazar District is also where most of the shrimp hatcheries producing seed to stock the farms, are located.

The USDA funded "Safe Aqua Farming for Economic and Trade Improvement" project (SAFETI) being implemented by Winrock International October 2016 – September 2021 will be working in the same five Districts (as listed in previous paragraph). The project aims to support the Bangladesh government's efforts to achieve the unrealized economic potential of shrimp and prawn farming. The project has two objectives:

1. Increase agricultural productivity by improving production and management of hatcheries and farms in the shrimp and prawn value chains to contribute to both improved incomes, food quality and safety, as well as to improve livelihoods and environmental sustainability in the Bangladesh prawn and shrimp industry.

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[4] Note: the terms 'shrimp' and 'prawn' differ in their usage around the world without a consistent biological basis. For the purposes of the project the customary USA usage is followed where the species grown in sea water or brackishwater are called 'shrimp' and the species grown in fresh water are called 'prawn'. Two main species are grown in Bangladesh: a 'shrimp', the Black Tiger (*Penaeus monodon*) known in Bangla as 'bagda' and a 'prawn', the Giant Freshwater Prawn (*Macrobrachium rosenbergii*) known in Bangla as 'golda'.

2. Expand trade of agricultural products by improving handling and sanitary controls, reducing unnecessary layers in the value chain, promoting extension services, and building the capacity of trade associations and government trade promotion bureaus.

The SAFETI project will be evaluated against 18 indicators (see below). As a key initial step in the project's monitoring and evaluation plan, a baseline study was carried out in March and April 2017 to establish the pre-activity values of these indicators and to check the assumptions underlining the project design. The Dhaka based company Consiglieri Private Limited (CPL) was selected to carry out the study in the five districts of Bangladesh where the USDA SAFETI project will be implemented: Khulna, Bagerhat, Satkhira, Jessore and Cox's Bazar.

The study collected baseline data (including on current practices, business performance, knowledge, challenges and constraints) from different shrimp and prawn value chain actors.

A total of 400 farmers of shrimp and prawn were the central focus of the study. It also extended to a wide range of other sector actors involved in the value chain, including input, output and regulatory actors. These were 75 in total:

- 4 x prawn hatchery owners;
- 6 x shrimp hatchery owners;
- 10 x sellers of feed and other inputs;
- 8 x owners of shrimp nurseries (pre-growing seed to a larger size before stocking in the main ponds;
- 7 x faria (small traders buying shrimp from farmers and selling on);
- 7 x aratdars (auctioneers of harvested shrimp);
- 5 x agents (financing post-harvest actors and controlling product flows);
- 5 x processors;
- 2 x feed manufacturers;
- 7 x Department of Fisheries senior staff;
- 2 x representatives of trade associations;
- 2 x buyers for overseas companies.

A separate survey was performed by SAFETI staff of 9 intensive shrimp farmers (a sub-sector of the industry comprising about 200 farmers operating 1,000 ha of ponds at a high intensity of production, with large capital investment and infrastructure. These farms produce 3-8 t/ha.yr.

The baseline study objectives are further illustrated in the diagram below:

Figure 1: Baseline Study Objectives

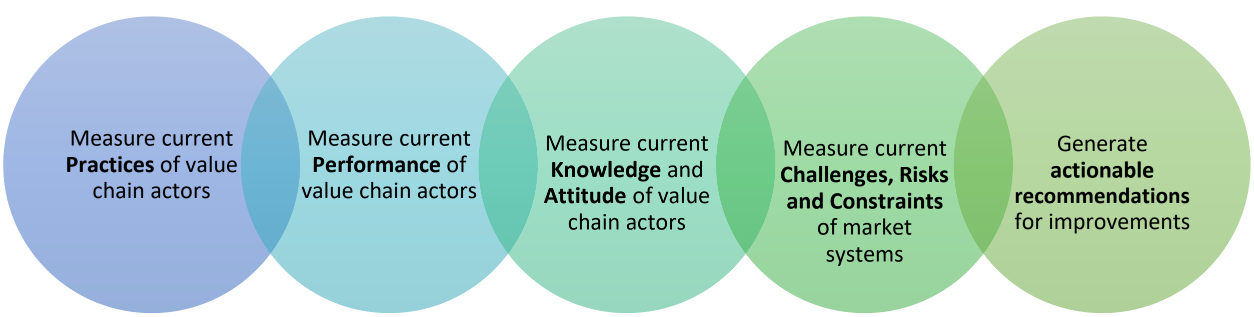

Table 1: SAFETI Project Indicators

USDA Food for Progress: SAFETI Performance INDICATORS - *December 2016*

#	Indicator	Proposal Proposed LOP Target (2016)	Adjusted LOP Targets	Baseline Values
1	**FFPr SI- 2:** Number of individuals who have applied new techniques or technologies as a result of USDA assistance	20,200	20,200	0
2	**FFPr SI-4:** Number of individuals receiving financial services as a result of USDA assistance	6,000	6000	0
3	**FFPr SI-5:** Number of loans disbursed as a result of USDA assistance	6,000	6000	0
4	**FFPr SI-6:** Value of loans provided as a result of USDA assistance	$1,050,000	$1,050,000	0
5	**FFPr SI-7:** Number of private enterprises, producer organizations, water user associations, women's groups, trade & business associations, & community-based organizations (CBO) that applied improved techniques and technologies as a result of USDA assistance	1,760	1,760	0
6	**FFPr SI-11**: Total increase in installed storage capacity (dry or cold storage) as a result of USDA assistance	1,612	dropped	n/a
7	**FFPr SI-13**: Value of sales by project beneficiaries	$6,550,000	TBD	$1,973,525 by 396 farmers
8	**FFPr SI-14:** Volume of commodities (metric tons) sold by project beneficiaries	TBD	TBD	258.7 mt by 396 farmers
9	**FFPr SI-16:** Number of individuals who have received short-term agricultural sector productivity or food security training as a result of USDA assistance	25,250	25,250	0
10	**FFPr SI-17:** Number of individuals benefiting directly as a result of USDA assistance	27,750	27310	0
11	**FFPr SI-18:** Number of individuals benefiting indirectly as a result of USDA assistance	438,750	438,750	0
12	**FFPr SI-12:** Number of policies, regulations, and/or administrative procedures in each of the following stages of development as a result of USDA assistance.	3	3	0
13	**Custom Indicator 1:** Improved production per ha (by direct project farmers)	500 kg/ha	500 kg/ha	306.3 kg/ha[5]
14	**Custom Indicator 2:** Increased sales of Specific Pathogen Free (SPF) and Polymerase Chain Reaction (PCR)-screened PLs by hatcheries	TBD	TBD	PCR: 2 billion, SPF:150million
15	**Custom Indicator 3:** Number of input suppliers/firms that sell or supply improved inputs as a result of USDA assistance	TBD	TBD	0
16	**Custom Indicator 4:** Number of buyer-seller linkages facilitated	TBD	TBD	0
17	**Custom Indicator 5:** Number of capacity building events for trade associations	TBD	TBD	0
18	**Custom Indicator 6:** Number of processing plants that obtain international certification	TBD	TBD	0

[5] Without Cox's Bazar farmers; average with them is 117 kg/ha

1.2 Analytical Approach for the Study

CPL reviewed SAFETI project documents to fully understand the project prior to carrying out the baseline survey. This included the project Results Framework, and other reports.

The diagrams below depict the results frameworks of the SAFETI project which informed the data collection work. There are two result frameworks for the project, one of which deals with agricultural productivity and the other with expanded trade of agricultural products. The diagrams broadly describe possible interventions, expected knowledge/skill/ capacity level changes, expected practice and behavior level changes, expected enterprise and systemic level changes, and finally, expected project impacts. Detailed analytical framework and key questions framed for each of the value chain actors are presented in Annex 1 (Table: 1):

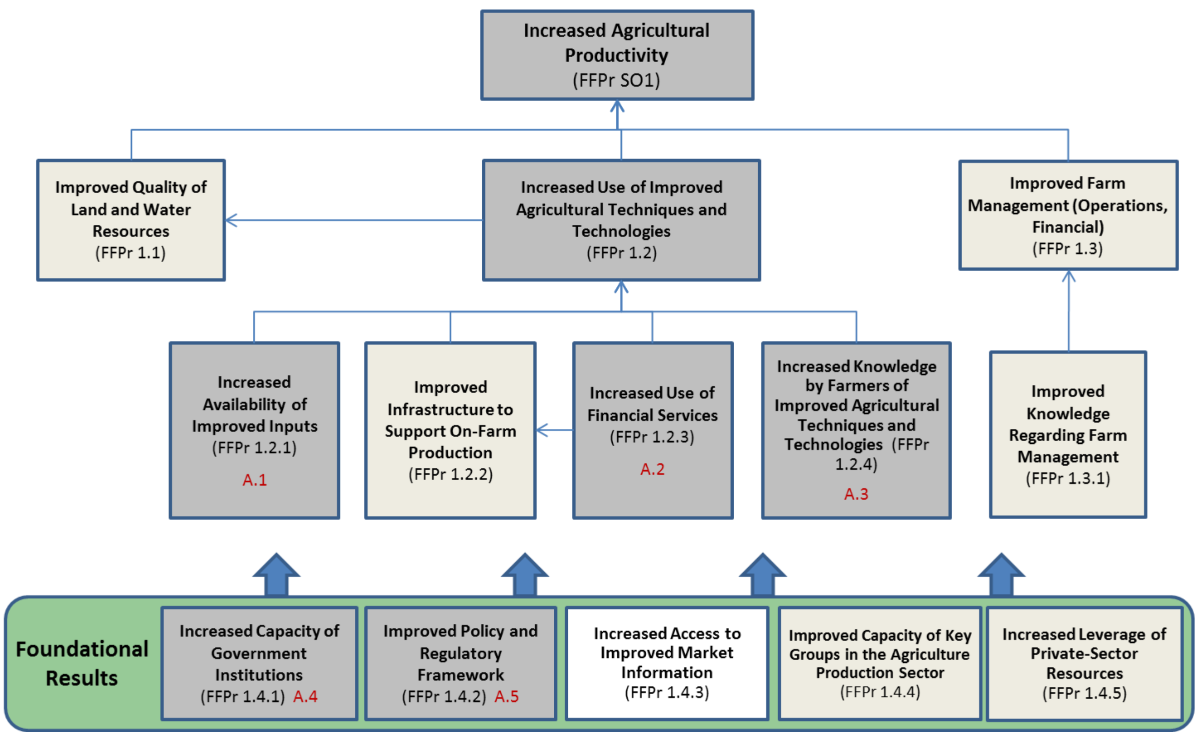

Figure 2: Project result framework No.1: Agricultural productivity

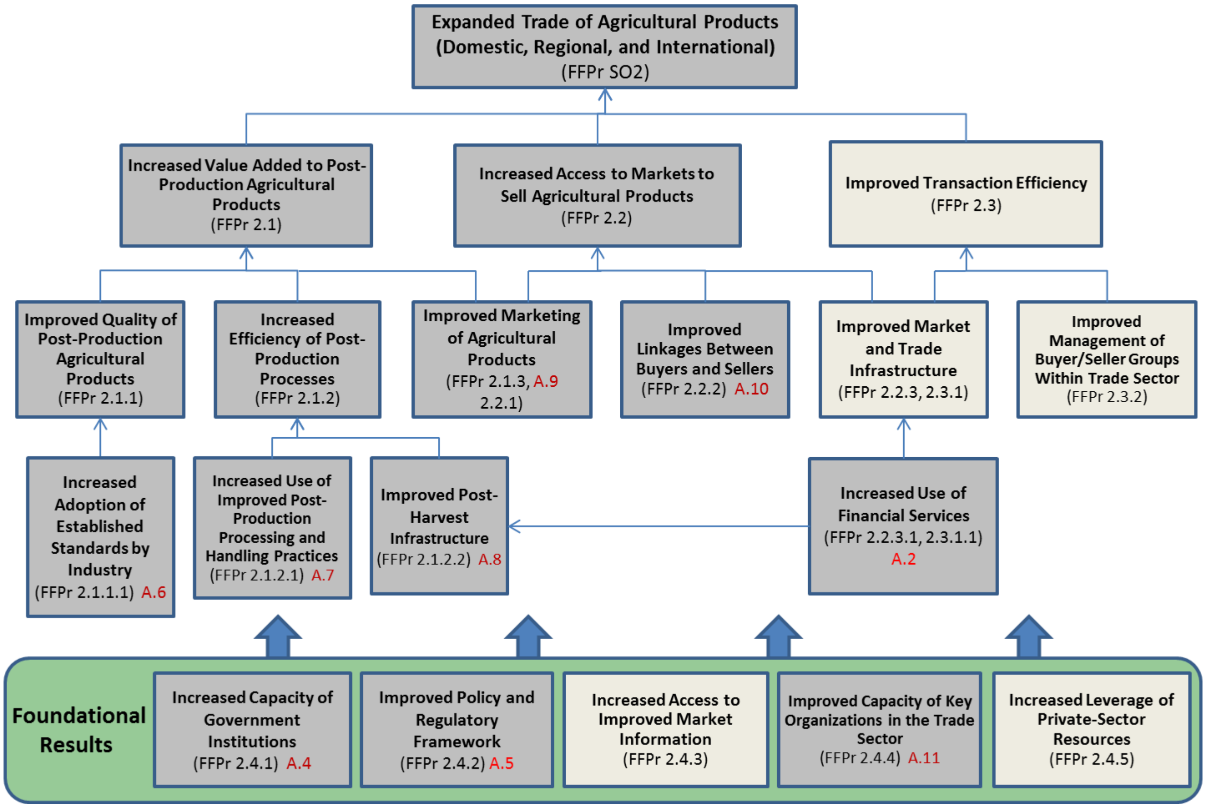

Figure 3: Project Result Framework No.2: Expanded trade of agricultural products

1.3 Shrimp and Prawn Value Chain

The Bangladesh shrimp and prawn farming sector involves a wide range of actors, and the baseline study was designed to include all of the key players.

The production chain begins with **mother shrimp and prawn** collected from the **wild**, or provided by overseas suppliers of **domesticated stocks**. These mother shrimp and prawn are held in **hatcheries** until they release their eggs or larvae and those **eggs and larvae** are reared in the hatchery through to the **post-larval** stage. The post-larvae are the life stage suitable for stocking in **farms**, and they are sold through a network of **suppliers** and **traders** to **farmers**, or via an intermediate **nursery** stage.

The shrimp are reared in ponds for 3-5 months per crop and the prawn for 6-8 months. Currently in most Bangladesh farms they are then harvested using traps, in small quantities every day or every few days and sent to **market.** There are a small number of **intensive** shrimp farms that do a single drain down harvest and deliver direct to **processing plants.** But most farm production is sold through a chain of **middlemen;** this chain includes **faria** (small-scale traders who buy from farmers), **aratdars** (people who run auctions taking commission for the product that flows through from farmers and faria to downstream buyers) and **depot holders** (larger scale traders who consolidate product and supply processing plants). At each step, product accumulates until there is a sufficient quantity to deliver to a processing plant. A small number of **account holders** or **agents** finance both upstream and downstream participants and control product flow between the farias, aratdars and depot holders, and the processors.

The processors export the frozen product to **overseas buyers.** There are some additional **agents** who arrange export sales and take a commission from the processors.

Input suppliers sell hatchery and growout feeds and chemicals, as well as various types of equipment used in production.

The following simplified infographics summarize the production chain. The Bangladesh shrimp and prawn value chains are complex, and to almost every step shown below there are exceptions. What is shown are the steps followed by the majority of these private sector actors and the shrimp and prawn as it moves along these chains.

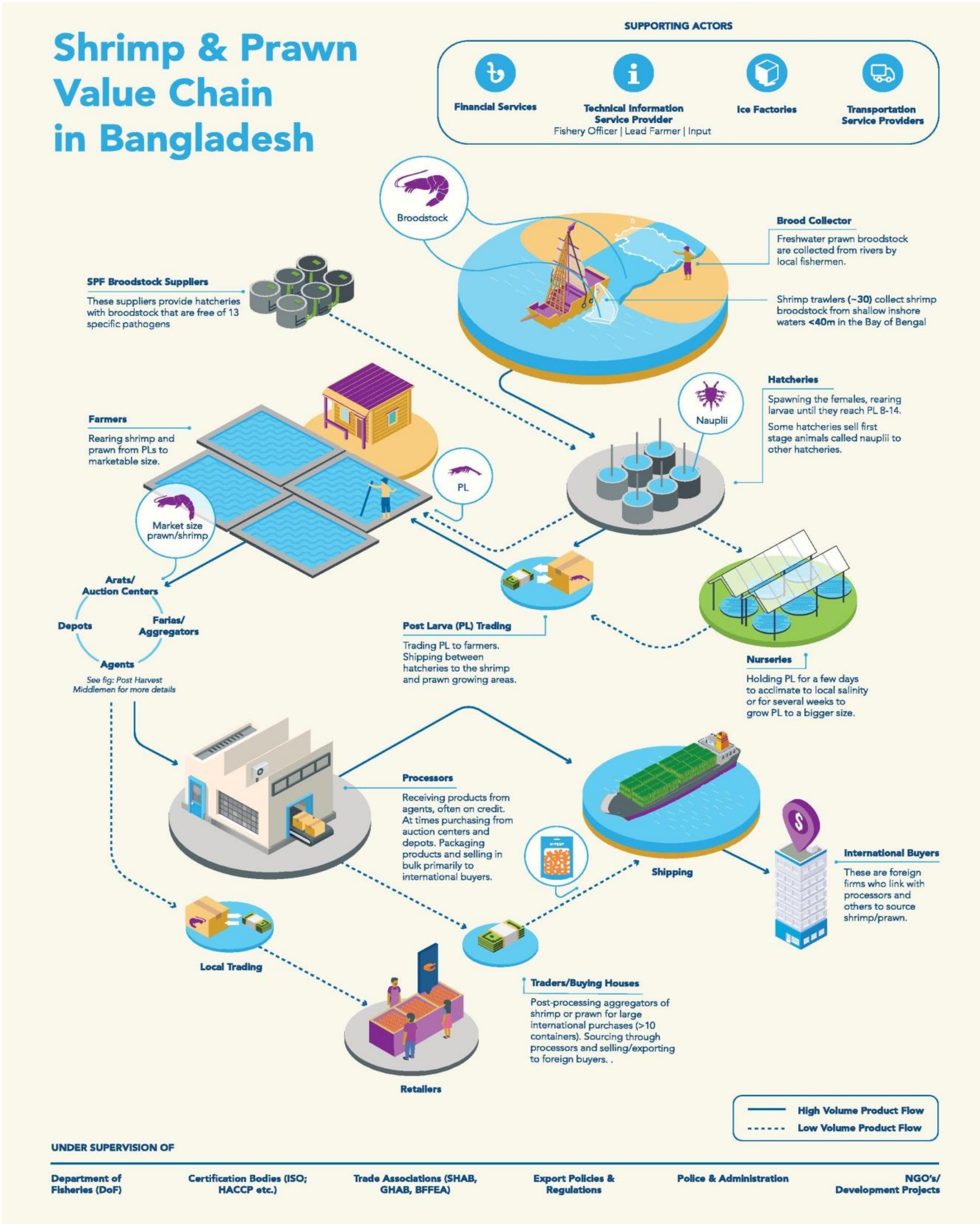

Figure 4: The Shrimp & Prawn Value Chain in Bangladesh

Further detail of the post-harvest chain involving several layers of middlemen: farias, aratdars, depots and agents:

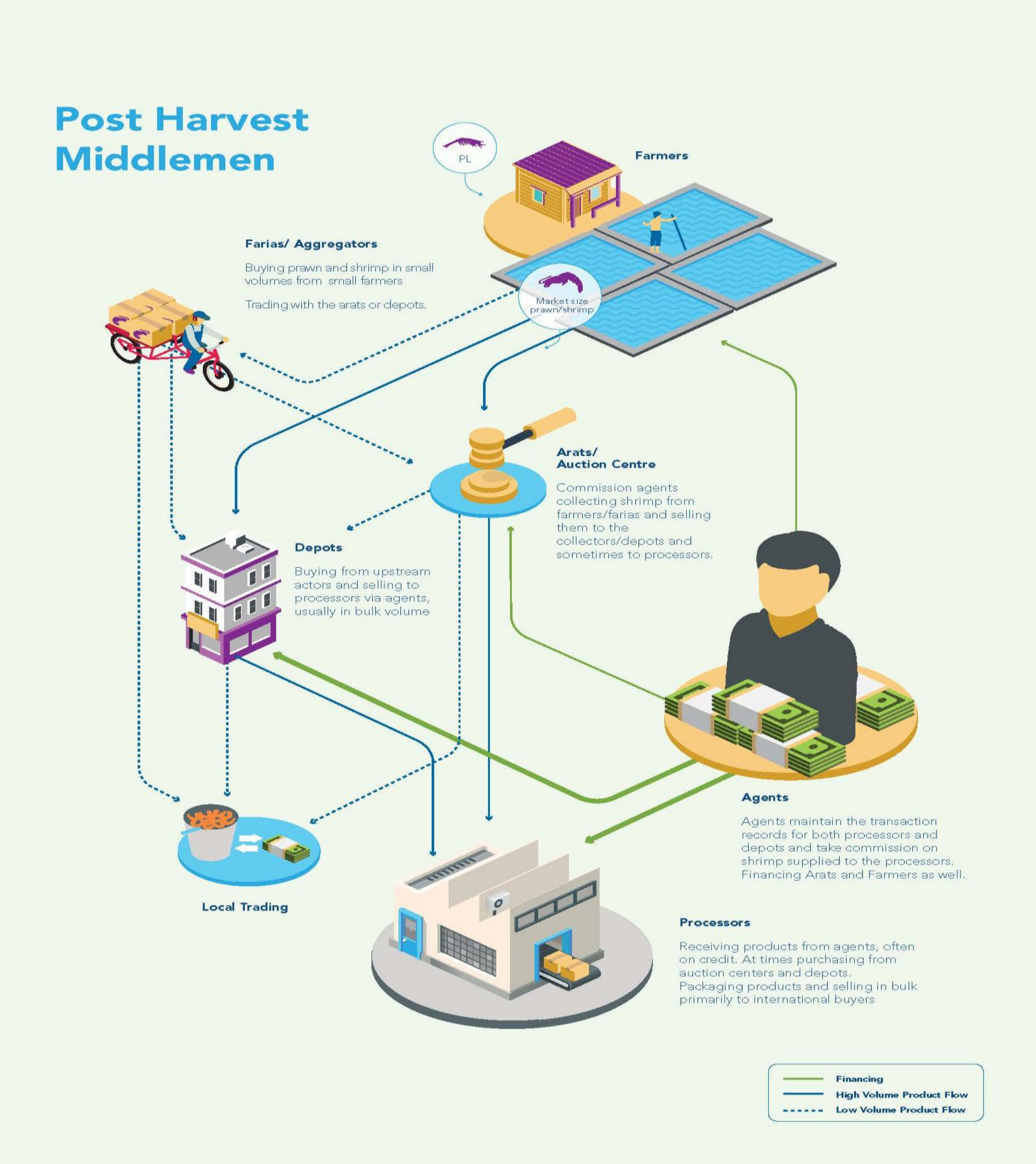

Figure 5: Detailed Illustration of the Post-harvest Chain Middlemen

1.4 Study Respondents

In alignment with the objectives of the project and scope of the study, CPL consulted with Winrock to formulate the type and number of study respondents to be interviewed for the study[6] as in the following table:

Table 2: Study respondents for the baseline study

Actors	Numbers interviewed
Prawn farmers (golda)	99
Shrimp farmers (bagda)	301
Total Farmers	**400**
Golda Hatcheries	4
Bagda Hatcheries	6
Input/Feed Sellers	10
Nurseries	8
Faria/Small Traders	7
Aratdar/Auctioneers	7
Depot Holders	10
Account Holders/Agents	5
Processors	5
Feed Manufacturers	2
DoF	7
Trade Associations	2
Buyers	2
Intensive farmers[7]	9
Total 'Other value chain actors' (excluding intensive farmers)	**75**

1.5 Study / Research Methodology

After a range of initial activities that included the development and testing of questionnaires (Annex 10) the field work was conducted using a mixed method sampling design:

1) **Probabilistic random sampling** was carried out for data collection from farmers (prawn and shrimp). Through this, relevant indicator information was collected that presents the socio-economic profile of the farmers and identifies specific vulnerabilities with regards to shrimp/prawn culture. 400 farmers (301 shrimp and 99 prawn) across the five project districts were sampled.

2) **Non-probabilistic judgmental sampling or purposive sampling** was adopted for collecting baseline data from the other market actors. These included prawn hatcheries (4), shrimp hatcheries (6), input sellers (10), nurseries (8), farias/collectors (8), aratdars/commission agents (7), depot holders (10), account holders/agents (5); processors (5); feed manufacturers (2); trade associations (2); buyers (2) and the Department of Fisheries (6).

[6] Page 12-14 of the Request for Proposal (RFP) document delineates the type of actors that needed to be included in the scope of the study.

[7] Data from farmers practising intensive shrimp farming were collected separately by SAFETI staff and are given in Annex 9.

A structured questionnaire was used for the farmers' survey and a semi-structured checklist was used to interview other value chain actors. Some limitations of the study were that:

1. Analyzing market behavior and incentive structure has intrinsic anthropometric components, which demand deep observation and open-ended discussion, but there were time and budgetary constraints.
2. Respondents such as farmers and other value chain actors were not familiar with the project since it had not begun implementation.
3. It was difficult for the team sometimes to get time from respondents for a proper interview.
4. The study was comparatively heavy on the survey part; while the number of Key Informant Interviews (KIIs) with other value chain actors was limited. However, a total of 75 Key Informant Interviews (KII) were conducted with 13 value chain actors.

Non-probability approaches with different market actors were deemed more suitable for in-depth qualitative research in which we tried to understand systemic constraints, problems and underlying factors, respondents' attitudes towards other actors and market relationships, etc. Furthermore, under the judgmental/purposive sampling method, **non-proportional quota sampling** techniques were explored. In this method, the study team specified the minimum number of sampled units they wanted to survey under each respondent category. The study team was not concerned with having numbers that match the proportions in the population; instead, it was ensured that enough samples from each category of respondents were included to get a clear picture of the baseline situation.

Sample sizes were selected based on a similar methodology to that developed by Cochran (1963)[8] and recommended by USAID, with a targeted 95% confidence level and 5% precision. Details are presented in Annex 2.

Over the life of the project SAFETI aims to reach 25,000 farmers in five districts of southern Bangladesh (Khulna, Jessore, Satkhira, Bagerhat and Cox's Bazar). This number is taken as the finite population size and the sample size (i.e. the number of farmers to be covered by the questionnaire survey to give results of a certain reliability) is calculated using the following formula (utilizing a similar methodology to that developed by Cochran's[9] and recommended by USAID.) : SS = [Z2*(p) * (1-p)]/ c2

Where, SS = Initial Sample Size; Z = Z value, which varies with the confidence level; p = a dichotomous probability variable, for p = 50% the formula results in highest sample size; C = Level of Precision.

Considering 95% of Confidence level and 5% Level of Precision, the initial sample size SS stands equal to 385. For calculating the sample size for a finite population (967,675 farmers), the following formula is used: n = SS/ [1 + {SS-1}/Pop]

Where, n = New sample size for finite sample; SS = Initial sample size for infinite sample; Pop = population size, which is assumed as 25,000 farmers.

Considering a 95% Confidence level and 5% Level of Precision, the new sample size against 25,000 farmers stands equal to 379 ≈ 400.

Initial desk review suggests that farmer involvement in prawn and shrimp subsectors can be roughly divided into 20% and 80% respectively[10]. However, through subsequent discussion with industry experts and in consideration of the dynamics of the study areas, the sample distribution was aligned with the research requirement. The sample distribution has been appended in the following table:

[8] http://www.sut.ac.th/im/data/read6.pdf

[9] http://www.sut.ac.th/im/data/read6.pdf

[10] http://en.banglapedia.org/index.php?title=Prawn

Table 3: Sample size for farmer survey divided according to shrimp and prawn farmers

Study Areas	Shrimp Farmers (Bagda)	Prawn Farmers (Golda)	Total
Khulna	80	30	110
Satkhira	71	9	80
Jessore	-	30	30
Bagerhat	60	30	90
Cox's Bazar	90	-	90
Total	**301**	**99**	**400**

The survey took place in selected sub-districts (Upazilas) within the five districts. The Upazila selection was based on where shrimp and prawn farming is most prevalent. This was determined in consultation with local government fishery offices. The detailed lists of Upazilas and locations of Focus Group Discussions (FGDs) are appended in the table below:

Table 4: Location of Survey Upazilas and Focus Group Discussions (FGDs)

Districts	*Shrimp (Bagda)*	*Prawn (Golda)*
Khulna	Paikgacha	Dumuria
Satkhira	Shyamnagar, Ashashuni, Kaliganj	Ashashuni
Jessore	--	Abhaynagar
Bagerhat	Rampal. Morolganj	Bagerhat Sadar
Cox's Bazar	Chokoria	--

Number of Focus Group Discussion (FGDs)		
Districts	*Upazila*	*No. and Type of Farmers*
Khulna	Dumuria	10 (Shrimp)
	Dumuria	10 (Female & Prawn)
Satkhira	Kaliganj	9 (Shrimp)
	Kaliganj	10 (Shrimp)
Jessore	Abhaynagar	10 (Female & Prawn)
	Abhaynagar	10 (Prawn)
Bagerhat	Rampal	11 (Prawn)
	Mollarhat	11 (Female & Prawn)
Cox's Bazar	Chakaria	9 (Shrimp)

1.5.1 Data Collection Tools & Methods

The survey (semi-structured interviews) was conducted with shrimp and prawn farmers to collect quantitative and some qualitative data on their production and management practices, performance, knowledge level, challenges and risks they face.

A total of 400 semi structured interviews were conducted. To complement quantitative findings from the survey, nine Focus Group Discussion (FGDs) were conducted with 90 farmers to know about their collective business approach, their attitude towards different technologies, value chain actors, products and services, major market constraints, challenges and risks they face. Three of these FGDs were conducted with women farmers to better gauge the gender dynamics in the shrimp value chain. Key Informant Interviews (KIIs) were also conducted with other value chain actors. The research tools used for data collection are detailed in Annex 2.

1.5.2 Data Coding, Cleaning & Analysis

On completion of data collection, filled-in questionnaires were coded for computerization and edited for consistency. Microsoft Excel was used for data entry and analysis. Experienced Data Entry Operators (DEO) carried out data coding, database development, and data cleaning. Data cleaning also entailed identifying and leaving out data outliers, which could potentially distort the overall output.

During data cleaning, data on 3 shrimp farmers and 1 prawn farmer were discarded as outliers (two shrimp farmers in Cox's Bazar with farm areas of 405 ha and 486 ha – making them unusually large land owners); one shrimp farmer in Khulna with a production of 4.86 t/ha classifying him as an intensive farmer; and one prawn farmer in Satkhira with a farm area of 24 ha, when the next largest farm area of all the other 98 prawn farmers was only 2.9 ha).

SAFETI has been provided with a full copy of the database and will also receive a set of the complete field questionnaires.

1.5.3 Overall Findings of the Baseline Study

Perhaps the most instructive finding of the baseline study from the sample of 475 interviewees is that the low production volume is a key issue affecting the whole shrimp/prawn sector, including the profitability of farmers and of many upstream and downstream sector actors; and it is holding back improvements in post-harvest handling, product quality and export value.

The low overall production affecting the sector is in turn due to the low productivity per ha: the baseline study found productivity levels of around 300 kg/ha.yr of prawn and shrimp. This compares with for instance 4.3 t/ha.yr in Thailand and 2.6 t/ha.yr in India [FAO][2]). Bangladesh has a vast area producing well below its potential due to poor seed quality and poor farming technologies.

Exporters, processors and overseas buyers comment that the black tiger shrimp grown in Bangladesh – *P. monodon* - is favored in some world markets over the species that dominates world production – the white-legged shrimp *P. vannamei.* White-legged shrimp now accounts for 80% of world farmed shrimp production, has lower production costs, but is considered in many markets as less tasty than the black tiger. However, the image of Bangladesh shrimp on the world market is one of low quality and with a risk of adulteration, including with antibiotic residues. As a result, Bangladesh shrimp (and freshwater prawn) competes on price, instead of on quality, a missed opportunity for the country.

Increasing productivity and product volumes will not only improve farmer incomes but will also make a major contribution to addressing the quality issue. This is because it will make the use of ice and better handling practices more economically viable, and encourage a shortening of the post-harvest delivery chain, which at present involves several layers of middlemen. Within these layers is where most of the damaging adulteration of the product currently takes place – including malpractices such as injection with gelatin and soaking in water to increase weight.

A new finding from the baseline survey was that while the use of ice has been a part of recommendations of government and a number of projects, downstream buyers (depots/arats) discourage its use, because of a fear of adulteration of the product and a misunderstanding of the factors involved. SAFETI will work to address this through training of downstream buyers and of beneficiary farmers.

The underlying assumptions of the project design and the relevance of the planned activities are supported by the findings of the baseline study. Modifications to two activities are recommended (see below).

1.5.4 Farmers' Survey

Findings

The study team conducted a survey of 400 farmers in the selected 5 districts. A comprehensive summary of the findings is attached in Annex 2. It was clear that farmers in general, while aware of some aspects of modern shrimp farming technologies, seldom follow the key, simple steps needed to ensure good production. Poor management practices are widespread.

The baseline survey confirmed and emphasized the need for many, (though not all), of the activities listed in the November 2016 Work Plan. The priorities indicated are:

- The need for good quality, disease-free seed.
  - Shrimp Hatcheries: expanded access to SPF or PCR screened animals.
    This is a policy issue SAFETI and its partners are already addressing.
  - Prawn Hatcheries: identify and solve the causes of the collapse of the golda hatchery sector.
    SAFETI is working with BFRI and others on possible solutions.

- The need for improved pond infrastructure - minimum 1 m depth and access to quality water.
  Resolving this is largely related to access to finance.

- The need for improved methods of pond preparation and management, and maintenance of biosecurity.
  - Effective disinfection- the use of sodium hypochlorite, rotenone or other products.
  - Effective liming
  - Effective water screening and water treatment - before stocking.
  - Effective exclusion of disease carriers (eg crabs) using netting
  - Well managed use of feed and fertilizers
  - Monitoring and maintenance of good water quality and animal health
    SAFETI will address these issues through training and outreach.

- The need for improvement in post-harvest handling.
  A new finding from the baseline survey was that while the use of ice has been a part of recommendations of government and a number of projects, downstream buyers (depots/arats) discourage its use, because of a fear of adulteration of the product and a misunderstanding of the factors involved. SAFETI will work to address this through training of downstream buyers and of beneficiary farmers.

Demographic and Income Information

The average age of the shrimp farmer respondents was 43 years (ranging 16-72), and of prawn farmers 45 years (ranging from 25-73). Household (HH) size ranged from 5 to 6 members for shrimp farmers and 5-8 for prawn farmers.

Shrimp farmer production of shrimp and prawns (most shrimp farmers also harvest small quantities of prawns) averaged 342 kg/ha.yr in Khulna District, 260 kg/ha.yr in Bagerhat District, 308 kg/ha.yr in Satkhira District) and 66 kg/ha.yr in Cox's Bazar District11.

Prawn farmer production of prawn and shrimp (some prawn farmers also harvest small quantities of shrimp) averaged 345 kg/ha.yr in Khulna District, 362 kg/ha.yr in Bagerhat District, 180 kg/ha.yr in Satkhira District and 253 kg/ha.yr in Jessore District. No prawn farmers were surveyed in Cox's Bazar District – little prawn farming is done there.

Shrimp farmer gross income from shrimp and prawn production averaged USD 2256/ha.yr in Khulna District, USD 1751/ha.yr in Bagerhat District, USD 1971/ha.yr in Satkhira District and USD 564/ha.yr in Cox's Bazar District[11]

Prawn farmer gross income from prawn and shrimp production averaged USD 2869/ha.yr in Khulna District, USD 3280/ha.yr in Bagerhat District, USD 1319/ha.yr in Satkhira District and USD 2108/ha.yr in Jessore District. No prawn farmers were surveyed in Cox's Bazar District – little prawn farming is done there.

The annual net profits made by the shrimp farmers surveyed and included, averaged USD 732 per ha in Khulna, USD 792 per ha in Bagerhat, USD 980 per ha in Satkhira and USD 532 per ha in Cox's Bazar. These included all the net profits from the operation of their ponds, with shrimp, prawn, fish and in some cases vegetables grown on dykes making a contribution. These profits compare with levels around USD 5-10,000 per ha.yr in neighboring countries such as Thailand, or USD 3-5000 per ha.yr on average in India.

The prawn farmers surveyed and included, reported annual net profits of USD 2664 per ha in Khulna, USD 2667 per ha in Bagerhat, USD 1941 per ha in Jessore and USD 2603 per ha in Satkhira, again including all the pond operations, shrimp prawn, fish and vegetables.

Pond/Gher Ownership

On average, the 298 shrimp farmers surveyed operated two ponds, though some as many as 5, with an average total pond and dyke area per farmer of 2.1 ha in Khulna District, 2.2 ha in Bagerhat District, 1.4 ha in Satkhira District and 19.8 ha in Cox's Bazar District. The structure of the shrimp sector in Chokaria Upazilla of Cox's Bazar District in the east of the country is different from the main shrimp farming areas of the greater Khulna area in terms of ownership as well as production methods.

This difference in average farm size between Khulna, Bagerhat and Satkhira Districts in the south-west and Cox's Bazar District in the east of the country merits some explanation. In the Khulna area farmers were originally subsistence rice farmers, unlike Cox's Bazar where due to historical reasons large blocks of government land were leased to individuals specifically for shrimp farming, and these in many cases are large absentee leaseholders. In the south-west Khulna region, land holdings are smaller though owners in many cases lease additional pond areas from neighbors.

There is little prawn farming activity in Cox's Bazar and this East-West difference is not seen in the prawn sector. The prawn farmers surveyed operated an average of two ponds (and as many as 5) and with average areas of 0.76 ha in Khulna District, 0.67 ha in Bagerhat District, 0.81 ha in Satkhira District and 0.87 ha in Jessore District.

An interesting finding was the increasing amount of leasing-in that is occurring:

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[11] The productivity and gross income data for Cox's Bazar will be re-confirmed by a follow up study as they appear very low.

- Shrimp farmers in Satkhira, Bagerhat and Khulna typically have their own ponds/ghers but also lease-in (48% of farmers in Khulna lease in; 47% in Bagerhat and 63% in Satkhira).
- In Cox's Bazar ownership is less common and most farmers lease-in (100% of those interviewed). For prawn farmers, most both own and lease-in ponds (23% of prawn farmers in Khulna lease in; 63% in Bagerhat, 57% in Jessore and 78% in Satkhira)
- Most leases are single, not joint and are for 2 to 5 years.

60% of the prawn farmers in Khulna and 70% in Bagerhat reported that their leased area has not changed in the last three years.

For 78% of prawn farmers in Satkhira and 57% in Jessore their leased area had increased.

A similar pattern was seen for shrimp farmers with the addition of increased leasing also being noted in Cox's Bazar.

90% of the prawn farmers across all four regions agree that leasing is very common in their respective areas nowadays and that the leasing tendency is growing every year.

A majority of both shrimp and prawn farmers would prefer longer leasing periods. Almost none had received financing from MFIs or banks for lease, capital or operating costs. Banks are unwilling to lend to farmers with leases of less than 4 years, and farmers are less willing to make capital investments if their security of tenure is short. SAFETI will work to encourage longer lease periods of 4-7 years to address these constraints. Details on leasing are in Annex 2 (Figures 3-8 and Tables 16-17).

Production Methodologies

Over 90% of shrimp/prawn farmers in Bangladesh practice extensive culture methods. In these, no supplementary aeration is used in the ponds and little supplementary feed is added.

As part of their risk management in the face of supplies of seed (post-larvae) that carry diseases, shrimp farmers carry out multiple stockings over several months and then make multiple harvests. Shrimp survival and productivity are very low compared to international standards. There is no single standard culture method used by farmers. Depending on location, local salinity, availability of inputs and knowledge, farmers follow a variety of methodologies, including shrimp and/or prawn in both monoculture and polyculture, with or without fish, in rotation with crabs, paddy, vegetables, salt production, or other diverse methods.

The baseline study made a point of interviewing a range of extensive farmers (301 shrimp and 99 prawn) operating in different environments. According to DoF 2014-2015 data, average shrimp and prawn production was 348 kg/ha and 711 kg/ha respectively.

However, the baseline data suggest an average production in the SAFETI target areas of only 306 kg/ha.yr for shrimp and prawn (see above).

Analysis of the survey data has brought to light specific aspects regarding farmer knowledge and practice which contributes to the low productivity of shrimp and prawn. Gaps in knowledge and practice have been identified in aspects such as:

Water Depth:

A minimum 3 feet water depth is important for reliable shrimp and prawn production, but many farmers are not able to maintain this:

Table 5: Percentage of shrimp and prawn farmers who maintain water depth of less than 3 feet

Shrimp Farmers				Prawn Farmers			
Khulna	Bagerhat	Satkhira	Cox's bazar	Khulna	Bagerhat	Jessore	Satkhira
40.2%	58.6%	70.5%	52.5%	1.7%	42.6%	-	72%

Shrimp and prawn farmers in all the districts mentioned that their ponds had been flooded at least once in the last three years, leading to loss of at least some portion of their crop. Detailed information about flooding and loss of crop is given in Annex 2 (Tables 21-26).

Use of Nurseries:

Most of the prawn farmers in Khulna (97%) and Jessore (80%) and most of the shrimp farmers in Khulna (53%) and Cox's Bazar (86%) use nurseries, which is a good practice; However, while most prawn farmers use earth dyke nurseries, many shrimp farmers use only a net pen nursery in the main pond; this has a number of disadvantages compared to the earth dyke method and is an issue SAFETI will aim to address.

Pond Preparation:

Correct pond preparation is important for good production, but the study indicates that good practice in pond preparation is generally not followed. The SAFETI project can address this issue through its training and extension activities.

More than 80% of the farmers surveyed have some basic knowledge of the need for, and components of, good pond preparation and general bio-security, but implementation is patchy. Small and medium scale farmers obtain most of their information on the subject from peers who have demonstrated good profits. However, they often do not have the necessary background knowledge or financial resources to properly apply the methods in their own farms.

For instance, applying lime to the pond before filling is an advisable step, but farmers often use the wrong kind of lime (calcium oxide instead of calcium carbonate) and in inadequate amounts. The pond should be rid of fish before filling: rotenone or tea-seed cake are effective and environmentally safe products to use for this purpose, but many farmers omit this step, or use dangerous poisons such as Endosulfan/Thiodin (an illegal chemical) or PhosToxin. There is a limited understanding also of the need for biosecurity and the steps such as net fencing around the pond that can contribute to it. SAFETI can address these issues through training and extension.

Water Treatment, Screening and Monitoring:

Screening of incoming water is critical to bio-security; overall 75-100% of the shrimp farmers surveyed provide some screening of their incoming water, but it is generally with a mesh size of 1-2 mm which is not fine enough to exclude fish eggs and disease carrying organisms. A high percentage of prawn farmers in Jessore and Bagerhat (77-100%) also screen incoming water but in Satkhira and Khulna this percentage falls to 50% or lower.

In general, the brackish water used for shrimp farming comes from rivers and canals which contain predatory fish and disease carrying organisms, making screening important. The freshwater used for prawn farming can come from a variety of sources; rainwater, tube-wells, or irrigation canals. Rainwater and tube-well water do not require screening.

The desirable practice of using bleaching powder (calcium hypochlorite), to disinfect and clean ponds before stocking, was low (less than 20% on average among both shrimp and prawn farmers). Khulna farmers were the highest users of bleaching powder, where 35% reported using bleaching powder.

Across the study area, around 30-40% of the shrimp farmers and around 50% of prawn farmers were found to be using a range of chemicals/medicines for water treatment. Zeolite, an alumino-silicate clay, was found to be the most common chemical used by both shrimp and prawn farmers. Farmers are unaware that Zeolite has been shown to be largely ineffective in improving pond conditions.

Both shrimp and prawn farmers were seen conducting some regular water quality monitoring activities such as measuring water temperature, salinity, pH (acidity) etc. However, the percentage of shrimp and prawn farmers practising such monitoring is still quite low: from 27 to 40% across the three districts of Bagerhat, Jessore and Cox's Bazar.

Sourcing of Post Larvae (PL):

Along with biosecurity and pond design problems (low depth and access to sufficient and good quality water) a major issue in Bangladesh shrimp and prawn culture is the lack of disease free seed.

Studies by WorldFish (WF) and others have shown that more than 50% of the shrimp PLs on the market are infected with White Spot Syndrome Virus (WSSV). The current baseline survey found that most farmers purchase post-larvae that have not been screened for disease. Only 10-15% of shrimp farmers were found to be sourcing PLs screened for disease by Polymerase Chain Reaction[12] (PCR) testing, and less than 5% were using High Health PLs produced from Specific Pathogen Free[13] (SPF) broodstock.

Knowledge about PCR tested PLs was found to be low among farmers (less than 50% of farmers across all regions) and only around 20-30% of farmers had ever heard of SPF or High Health. Farmers buy PLs from a variety of sources depending on availability and price – the most popular source in most, but not all, districts being the wholesale PL markets. The supply to these markets comes both from the wild and from hatcheries and includes both PCR tested and untested seed.

Table 6: Source of PL and percentage of usage per District

Shrimp					
District	**Hatchery**	**Nursery**	**PL Wholesale Market**	**Mobile PL Vendor**	**Others**
Khulna	7.5%	12.5%	89%	11%	1%
Bagerhat	8%	20%	85%	40%	0%
Satkhira	10%	59%	28%	27%	1%
Cox's Bazar	91%	4%	8%	41%	2%
Prawn					
District	**Hatchery**	**Nursery**	**PL Wholesale Market**	**Mobile PL Vendor**	**Others**
Khulna	0%	0%	100%	10%	0%

[12] **PCR** is a technique used to reproduce (amplify) selected sections of DNA or RNA for analysis. It is important in the identification of a range of viral, bacteria and other diseases. Easy-to-use test kits are now available for the main shrimp and prawn diseases affecting aquaculture. These techniques are effective in sick or moribund animals – less so when animals have minimal amounts of the virus or plasmids. Then there is a need for multiple tests or more specialized stress tests.

[13] Specific Pathogen Free: SPF shrimp or prawn are free of specific pathogens, in this case the common shrimp and prawn diseases. SPF shrimp or prawn stocks must be maintained in indoor facilities under strict biosecurity and held for several generations before they can be considered of SPF status. The PLs produced from SPF broodstock can be marketed as High Health (HH) seed. In addition, the commercially available SPF strains are in most cases genetically improved; for instance some *P. monodon* SPF stocks are 30-40% faster growing than wild stocks.

Bagerhat	7%	10%	87%	37%	0%
Jessore	0%	0%	77%	23%	7%
Satkhira	0%	0%	0%	100%	0%

Under the Bangladesh Shrimp Hatchery Act, the production and stocking of PCR tested PL is mandatory and all hatcheries should market only PCR tested PL; however, the regulation is not currently enforced. Use of High Health seed is not mandatory but wider availability of it would be very beneficial to farmers. Currently, only one Bangladesh hatchery is authorized to produce it, and last year supplied only 100-150 million PLs, approximately 1% of the total market.

A key underlying issue is Bangladesh's continued use of diseased wild brood stock for both shrimp and prawn seed production. Elsewhere in the world, domesticated and/or SPF brood stock are estimated to make up 85% or more of all shrimp brood stock used. Diseased seed, combined with inadequate bio-security on the farms and poor pond design and infrastructure issues are the major factors holding back productivity in Bangladesh.

Interestingly, more than 90% of farmers mentioned that they would be willing to pay a higher price to obtain PCR tested and HH PLs, as opposed to untested PLs, but not a price as high as the current differential.

The survey also asked farmers about the factors determining their choice of the type of PL they bought last season. Around 80% of shrimp farmers across all regions (except Cox's Bazar) mentioned that *availability* was the most important factor, then followed by quality and price. 70% of farmers in Cox's Bazar however considered that *quality* came first when they decided which PL to buy. These findings can help inform development of SAFETI strategies to address the constraining issues.

Stocking Frequencies and Densities at Nursery and Grow-out Stages:

The frequency of stocking by shrimp farmers is unusually high in world terms, typically up to eight times in a season at about two week intervals. Multiple stocking is not ideal as the shrimp will be of different sizes in the pond; this complicates feeding, water and health management and leads to higher cannibalism. However multiple stocking is a common practice in Bangladesh extensive shrimp ponds as farmers have found it reduces their risks in the face of poor seed quality and the low survivals they experience. As part of the improved methodologies to be introduced, SAFETI will encourage the single stocking and single harvesting that is the common practice in most other countries.

Prawn farmers stock fewer times – typically up to three times, and with long intervals in between. This suits their harvesting patterns and the practice of holding animals over winter to sell to the high value market at the beginning of the following season.

The study also found that some farmers are using culling [14] in their management. Prawn stocking and harvesting needs to be managed in a different way to shrimp, because of the complex social structure and size variation in dominant and non-dominant males in the pond; so in the case of prawn, multiple stocking and harvesting can make some sense. However, overall production can be increased with a single stocking and regular culling of females and dominant males. These are the practices that will be among the improved methods SAFETI will promote.

Shrimp stocking densities at the *nursery stage* were found to be highest in Khulna at 138 per m^2, compared to 98 per m^2 in Bagerhat, 78 per m^2 in Satkhira and 22 per m^2 in Cox's Bazar.

[14] Cull harvesting: in freshwater prawns, refers to the removal of 'blue-claw' males and females, allowing smaller faster growing 'orange-claw' males to grow. The complex social structure in prawns where large 'blue-claw' males inhibit the growth of 'orange–claw' males and 'small' males is a phenomenon not seen in shrimp.

In the case of prawns, stocking density at the *nursery stage* was 46 per m^2 in Khulna, 7 per m^2 in Bagerhat and 26 per m^2 in Jessore. The duration of the nursery stage varies between farms and affects what would be a recommended density to stock at, but higher densities reflect the response of farmers to the poor survivals they often experience with diseased seed stock.

SAFETI will source clean seed for its target farmers and promote stocking rates of 50 per m^2 and a nursery stage of 20-30 days to reach 1-3 g size before transfer to the growout pond.

Stocking densities at the grow-out phase were around 5-10 per m^2 for shrimp farmers and 1-3 per m^2 for prawn farmers. For shrimp, these levels are high and are a response by farmers to the poor survivals they experience. With Good Practice, farmers could be harvesting 1000 kg of shrimp per ha (three times the current average) stocking only 4-5 per m^2. For prawns the densities could be increased with better pond management methods.

Many shrimp and prawn farmers practise polyculture with fish including Indian major carps and exotic fish such as Chinese carps and tilapia (*Oreochromis nilotica*).

Feeding Practices:

The survey indicates that shrimp farmers in general use very little feed, providing a commercial feed only at monthly or weekly intervals, which offers little direct contribution to shrimp nutrition, though it probably does contribute to pond fertility. [15] The SAFETI project will promote better feeding practices.

Prawn farmers use feeds at a much higher rate than shrimp farmers - though the presence of fish under a polyculture system may make this of questionable economic value, as the fish will tend to eat most of the feed.

The survey indicates that more than 80% of the prawn/golda farmers use homemade feed across all districts except Satkhira where the figure was 40%. In the case of shrimp/bagda farmers around 40-50% of farmers irregularly use homemade feeds (except Bagerhat where 91% use it).

Prawn farmers use feed from multiple sources, i.e. farmers using homemade feed are also using industrially produced feed. In the case of prawn farmers, the feeding frequency across districts is not consistent but it was seen that in Jessore and Khulna, most prawn farmers were feeding once or twice a day, whereas in Satkhira, farmers were applying feed twice a week.

Of the commercial feeds, available in Bangladesh, Quality Feeds[16] was the most popular brand among prawn/golda farmers interviewed for this study, cited by 40%-70% across all regions.

Farmers use a variety of ingredients for formulating homemade feed such as rice bran (polish), wheat bran, oil cake, soya meal, etc. Use of wild snails as feed (which is illegal) is also reported to be practised by some prawn farmers.

The intensive shrimp farmers (about 1000 ha of farms in Bangladesh practise intensive farming – using higher stocking densities that require supplementary aeration, good quality feeds and that lead to harvests of 3-4 t/ha.crop, twice per year), mostly use imported feeds, with Charoen Pokphand (CP)[17] being the most popular brand. 70% of the intensive shrimp farmers use CP feed.

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[15] As well as the national feed producers Bangladesh now has 3 multinational feed companies, CP, New Hope and Tangwei. CP is the world's largest producer of shrimp feeds, Tangwei is China largest producer of shrimp feeds, New Hope is another large Chinese producer of shrimp. None of these are producing feeds in Bangladesh, but all have the expertise to produce high quality feeds if the market for prawn or shrimp feeds grows.

[16] http://www.qfl.com.bd/

[17] http://www.cpbangladesh.com/

Chemical Application During Pond Preparation and Grow-out:

Use of harmful and illegal chemicals is a threat for the industry and its overseas markets. The use of antibiotics was notable among Khulna shrimp farmers (12.5% reported usage) and use of fungicides was reported by 27.5% of shrimp farmers – but only in Khulna. Across all districts, an average of 8% of shrimp farmers use probiotics, 4% anti-parasite medicines, 5.3% disinfectants and 5.1% antibiotics. In the case of prawn farmers around 15% use probiotics.

Lime when used properly, is not harmful and can support good production. Use of various forms of lime during the grow-out phase was quite common among both shrimp (73%-86%) and prawn farmers (77% -100%) across all districts, but except in Cox's Bazar, it was mainly the wrong sort of lime that was used - calcium oxide – rather than one of the correct forms, calcium carbonate or dolomite. Only in Cox's Bazar were the correct forms used, and that by more than 80% of farmers. However generally farmers do not apply sufficient quantities to have the appropriate beneficial effects.

Disease:

Survival rates during culture were seen to be low, more so for shrimp than prawn farmers. Most farmers estimated their shrimp and prawn survival rates are below 50%.

Analysis of data from the earlier AIN and STDF projects run by WorldFish and FAO suggests shrimp survival rates were typically 15-30% and for prawn they averaged 43-44%. In other countries survival rates of 70% from PL to harvest are the norm.

Farmers cite disease as the main issue affecting survival, 85% of shrimp farmers and 57% of prawn farmers reporting that they were affected by disease in the last three years. They consider that viral diseases are the most common, followed by those caused by bacteria, but they have no laboratory test results to support these conclusions, and typically do not seek any testing. Around 80% of prawn farmers in Satkhira reported parasitic diseases.

Harvest & Post-Harvest:

Shrimp farmers report that they harvest frequently – as many as 100 times in a year. More than 70% of farmers in Khulna harvest more than 50 times in a year with one-third harvesting 100 times or more in a year. In Satkhira 70% of farmers harvest more than 100 times a year, and in Cox's Bazar 42%. In Bagerhat harvesting frequency is lower with most farmers harvesting 20-50 times a year.

The small quantities harvested each time make it difficult to implement Good Handling Practices (GHP) such as killing the shrimp in an ice slurry (chill-killing) and shipment to market on ice. Traceability is also made more difficult. SAFETI will source disease screened seed for beneficiary farmers and encourage single stocking and single harvesting as part of the improved methodologies to be demonstrated.

Prawn farmers generally harvest less frequently; 2-8 times per year, but in the case of prawns, this is appropriate so that large males and females can be regularly culled, as this practice boosts overall productivity. 100% of farmers in Khulna and Jessore and 80%-90% in Bagerhat and Satkhira practise cull-harvesting.

Washing the shrimp and prawn immediately after harvest is common except in Khulna, where 71% of the farmers reported they do not clean the product after harvesting.

Use of ice or chill-killing techniques (desirable if good quality product is targeted) was seen to be very low among all farmers; it was the highest in Cox's Bazar at 11%. Apart from Cox's Bazar most farmers do not use ice; in Khulna 95%, Bagerhat 82% and Satkhira 99% of farmers said they do not use ice. They mentioned that use of ice is generally discouraged by local buyers (depots, arats) since they believe that it artificially increases the weight of the product. It generally takes from 2-5 hours after harvest for the shrimp or prawns to reach the arat or depot.

Sales:

The study investigated to whom farmers are selling their produce and at what price. The figures below depict to which actors the shrimp and prawn farmers are selling their products:

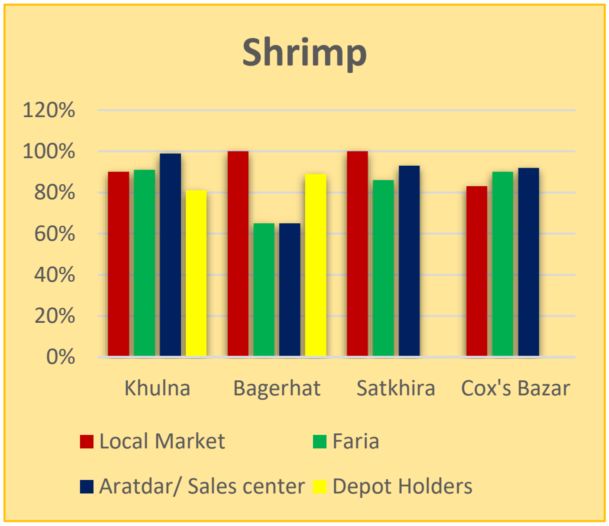

Figure 7: Actors to whom shrimp farmers are selling (expressed as % of shrimp farmers, accounting for multiple responses)

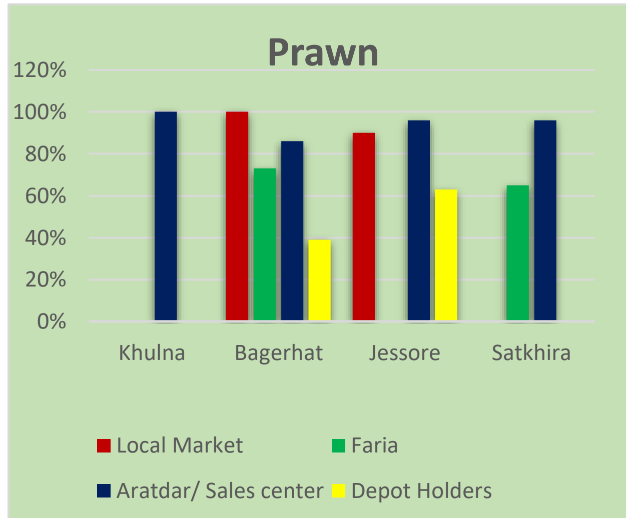

Figure 6: Actors to whom prawn farmers are selling (expressed as % of prawn farmers, accounting for multiple responses)

Farmers sell to a variety of actors depending on several factors such as convenience, price, credit arrangements and prior relationship.

Productivity and Profitability:

Productivity per hectare is an important indicator to gauge farmer performance. Detailed information on the major crop and other supplementary crops was collected for both shrimp and prawn farmers. Many farmers are following polyculture practices, cultivating shrimp and prawn together, as well as with fish and wild shrimp such as *horina*.

The table below depicts the productivity per hectare for shrimp farmers, considering their other products as well.

Table 7: Production (in kg) per hectare for shrimp farmers (includes other crops as well)

Shrimp farmers' production per hectare (kg)				
Particulars (last year data)	**Khulna**	**Bagerhat**	**Satkhira**	**Cox's Bazar**
Shrimp	308	240	303	66**Error! Bookmark not defined.**1
Prawn	34	20	6	0
Fish	219	238	283	200
Other shrimp (Horina)	24	11	34	134
Total Production	**585**	**509**	**626**	**400**

Shrimp production averaged more than 300 kg/ha in Khulna and Satkhira, and was 240 kg/ha in Bagerhat. In Cox's Bazar, the average was much lower (66 kg/ha), mainly due to the fact that farmers there cultivate in larger ponds/ghers using very extensive methods**Error! Bookmark not defined.**. Notably, the production of fish is almost equal to that of shrimp, adding extra income for the farmer.

The table below details the productivity per hectare for prawn farmers, considering their other production as well.

Table 8: Production (in kg) per hectare for prawn farmers (includes other crops as well)

Prawn Farmers' Production per hectare (KG)				
Particulars (last year data)	Khulna	Bagerhat	Jessore	Satkhira
Prawn	338	277	253	106
Shrimp	7	85	0	75
Fish	385	213	407	327
Horina	0	0	7	90
Total Production	**730**	**575**	**667**	**598**

Prawn production for prawn farmers ranged 106-338 kg per hectare. Prawn farmers also often stock shrimp and this was more evident in Bagerhat and Satkhira. Fish also make a significant contribution to total production; in some cases, the fish harvest is more than the prawn.

Revenue per Hectare

Shrimp and prawn farmers averaged total revenues (from shrimp and prawn) as follows:

Table 9: Shrimp and prawn farmer average total revenues

District	Shrimp farmers USD per ha	Prawn farmers USD per ha
Khulna	**2256**	**2869**
Satkhira	**1971**	**1319**
Bagherat	**1751**	**3280**
Jessore		**2108**
Cox's Bazar	**564**Error! Bookmark not defined.	

Prawn farmers enjoy a much better return per hectare compared to shrimp farmers. The highest revenue per hectare was observed in Khulna and lowest in Bagerhat. The total revenue includes contributions from shrimp, prawn, fish and also vegetable cultivation on the dykes.

Cost Benefit Analysis:

Detailed cost and revenue figures were collected from the farmers to construct a cost benefit analysis:

Table 10: Cost benefit analysis per farmer for shrimp and prawn farmers

Particulars	Shrimp				Prawn			
	Khulna	Bagerhat	Satkhira	Cox's Bazar	Khulna	Bagerhat	Jessore	Satkhira
Average total revenue per farmer (BDT)	466,613	383,727	305,840	1,981,968	326,050	242,945	286,767	296,202
Average total cost per farmer(BDT)	342,872	246,292	197,496	1,141,319	165,071	99,049	151,847	126,978
Average profit per farmer(BDT)	123,741	137,435	108,344	840,649	160,979	143,896	134,920	169,224
Average profit per farmer/USD	**1,547**	**1,718**	**1,354**	**10,508**	**2,012**	**1,799**	**1,687**	**2,115**

Shrimp farmers are making annual profits of USD 1354 – USD 10,508 (averaged by District), from their cultivation of shrimp and other crops (including vegetables grown on the dykes). Farmers in Cox's Bazar are performing better than those in other districts; this is mostly due to the larger farm areas they operate, which compensates for the much lower productivity per ha.

For prawn farmers, the annual profitability per farmer was similar across all districts and ranged from USD 1,687 to USD 2,115.

The annual net profits made by the shrimp farmers surveyed averaged USD 732 per ha in Khulna, USD 792 per ha in Bagerhat, USD 980 per ha in Satkhira and USD 532 per ha in Cox's Bazar.

These included all the net profits from the operation of their ponds, with shrimp, prawn, fish and in some cases vegetables grown on dykes making a contribution. These profits compare with levels around USD 5-10,000 per ha.yr in neighboring countries such as Thailand, or USD 3-5000 per ha.yr on average in India..

The prawn farmers surveyed reported annual net profits of USD 2664 per ha in Khulna, USD 2667 per ha in Bagerhat, USD 1941 per ha in Jessore and USD 2603 per ha in Satkhira, again including all the pond operations, shrimp prawn, fish and vegetables.

Detailed cost particulars for both shrimp and prawn farmers are included in Annex 2. (Table 67-68)

Farmer Satisfaction with Return:

Farmers were asked about their satisfaction or otherwise with the returns that they were generating from shrimp and prawn culture. The findings give a mixed picture. Many shrimp farmers were indifferent and see their gher production as an ancillary activity, to which they are not ready to dedicate more time and money, or take more risk. Half of the farmers in Khulna mentioned that they are happy with their Return on Investment (RoI). In the case of prawn farmers, most in all districts except Jessore, were dissatisfied with their returns or described themselves as indifferent.

Source of Information and Training Needs:

Farmers rely on their peer farmers for advice regarding culture methods. The most used media for sourcing information is television. Most farmers have not received any formal training and they expressed a need for training: training in disease management and modern technologies to improve their farm productivity being their most common request.

Usage of 'phones is very prevalent among the farmers irrespective of sector and region. 84% (Satkhira) to 97% (Cox's Bazar) of farmers utilize 'phones in their daily lives. Smartphone usage is highest in Khulna (19%) and lowest in Bagerhat (5%). A majority of farmers (shrimp: at least 79%;

prawn: at least 80%) use their ‘phone to collect information on farming methods and markets. More information regarding ‘phone usage is presented in Annex 2.

The GoB sends different informative/awareness raising messages to farmers via their ‘phones. Most said they do not read them. Satkhira (30%) has the highest percentage of shrimp farmers who read these messages, and Jessore the highest percentage of prawn farmers (30%).

Record Keeping of Gher/Pond Management:

Record keeping of pond/gher management issues is a good practice that farmers should adhere to. Around 50-60% of shrimp farmers across all districts were found to maintain some regular records of pond management.

For prawn farmers, the percentage of farmers was 45-60% (except for Bagerhat-only 20% of farmers). Details are presented in Annex 2 (Table 51).

Farmers were also asked how they got to know and learn about record keeping. Most responded that they were self-taught with some noting the contribution of peer farmers/lead farmers.

Perception about Farming in Groups through a Cluster Based Approach:

The majority of the farmers surveyed are not part of any cluster group.

The shrimp farmers in Cox’s Bazar are the most involved in a cluster or group (24%). In the case of prawn farmers, only Khulna respondents (13%) claimed they are part of a group.

Opinion on benefits of working collectively differs from area to area. Most shrimp farmers of Jessore, Satkhira, Bagerhat and Cox’s Bazar believe that it would be beneficial. In the case of prawn farmers, it was seen in Jessore and Satkhira that almost all the farmers thought that working collectively would be beneficial for them. However, in Khulna and Bagerhat, perceptions about collective farming were not so favorable.

Perception about *P.vannamei* Culture:

Farmers were asked if they knew about the South American species of shrimp now being farmed in neighboring countries, the white-legged shrimp *Penaeus vannamei*.

The majority of the farmers did not have any knowledge of it. Khulna had the highest percentage of shrimp farmers (11%) who had heard about “*vannamei”*. Among prawn farmers, those in Bagerhat had the highest percentage who had heard about it (10%) and in Satkhira, none had any knowledge of it.

Respondents were further asked whether they would be interested in culturing “*vannamei”* in future. A majority of shrimp farmers expressed interest, except farmers in Satkhira, who mostly replied in the negative. In the case of prawn farmers, Bagerhat and Jessore respondents showed keen interest in “*vannamei”* culture but farmers in Khulna and Satkhira less so.

Access to Finance:

A lack of access to finance was reported by both shrimp and prawn farmers. Most farmers self-finance using their own or family funds to support their farming endeavor. The use of loans/credit from banks or NGOs was seen to be low.

The problem is that the micro loans available are generally too small to be of use to shrimp and prawn farmers and the repayment schedule too fast (usually starting immediately after receipt of the loan, whereas farmers need several months until first harvest.)

Relationships with Other Market Actors:

Farmers deal with a whole host of actors both for buying inputs and selling their produce. The relationship dynamics with the various actors was one of the aspects that was investigated in the study into. Farmers were asked to list down the actors with whom they have a direct business relationship.

Field data show that shrimp farmers have direct contact with a whole host of actors. Interestingly, some farmers in Cox's Bazar have links with a processor, which was not seen in other areas. Most farmers have relationships with the aratdar (auctioneer), suggesting that farmers are bringing more and more produce to the arats (auction), instead of selling to the faria (small middleman trader).

As for prawn farmers, it was seen that most farmers have frequent contact with input sellers and local PL traders. Notably, interaction with faria is not so much but with the aratdar the interaction is quite high; suggesting for prawn also, a shift in preference of selling to the arats. Only a few farmers in Khulna have direct relationships with processors.

Details are presented in Annex 2 (Figures 46 and 47)

Women in Shrimp and Prawn Farming:

The survey team conducted three FGDs with 31 women farmers in Khulna, Bagerhat and Jessore to understand the role and participation of women in shrimp and prawn culture.

The women farmers mostly culture golda/prawn. There were almost no women farmers farming shrimp.

Even though the main survey interviewed mainly men (of 400 interviewees only two were women), the FGDs brought to light that the participation of women is actually considerable in most of the on-farm activities.

Where the ghers and ponds are located fairly close to their homesteads, they have full involvement in the day-to-day operations and management, have decision-making authority and control over savings as well as getting help, respect, and support from family members.

The women farmers interviewed are quite aware of their socio-economic rights within the patriarchal context and have ventured to avail themselves of opportunities for obtaining loans from MFIs and technical advice from the local government fisheries offices.

In Khulna and Bagerhat, the FGDs were conducted with women prawn farmers' groups supported by the Upazila level DoF offices. These women have attended training sessions and received advisory support from the DoF which has encouraged them to undertake prawn culture. In the case of Satkhira and Chakaria in Cox's Bazar, the farms are mainly for shrimp, larger in size and located far from the home, thereby limiting women's involvement.

The main challenges faced by women were similar to those reported by the male farmers interviewed: unavailability of prawn PL seed, high mortality of the prawn PL, diseases causing loss of harvest and natural disasters. Despite the challenges faced and losses incurred, they were still interested in continuing prawn culture since it is less labor-intensive and more profitable compared to other agricultural interventions such as vegetable cultivation.

In procurement of inputs (seed, feed, chemicals) and sale and marketing of prawns, women are not involved unless the woman is head-of-household. The men of households take charge of buying inputs and selling the harvest. However, the women also report that this is a norm that they are comfortable with and the men give the women the proceeds from sales of the prawn. The women use the extra income from prawn culture for their children's education and for overall household needs.

Women have good access to cell ‘phones and some report that it is a good way to get information regarding better culture practices, communication with input retailers and their buyers like the farias.

Major Constraints to Increased Productivity and International Trade:
In summary, at the farmer level these have been identified as including:

Low productivity: Farmers are aware that productivity is low. Most extensive farmers in shrimp and prawn areas are illiterate, formerly subsistence rice farmers, but growing numbers are aware of the possibilities for better shrimp and prawn production.

Low price of produce: Farmers feel that the price of shrimp and prawn has been declining in the last three years or so in the international market; the impact of which has also affected farmers. This is correct in terms of prawn - less so for shrimp.

Losses to disease: Almost all shrimp and most prawn farmers mentioned notable losses due to viral disease.

High cost of inputs/feed: Farmers opined that the high cost of feed and PL reduces their profitability. Most farmers are not aware of the cost of feeds on the international market.

Lack of training: Most farmers reported that they lack proper training on correct cultivation techniques and thus they are not fulfilling their full potential. They requested training on disease management and on the use of modern technology for farming. They have learned the information from their peers but feel that they lack proper training in these areas.

Lack of quality PL: Almost half of the farmers mentioned this to be a major problem. Farmers often attribute high mortality in their ponds/ghers due to low quality PL or disease affected PL.

Natural disasters: Flooding and heat were reported by farmers as major impediments to successful culture. Almost all farmers faced various magnitudes of flooding in the last three years which led to considerable economic loss for them.

Access to low-interest, collateral-free funds: Shrimp and prawn farmers do not have access to low interest funds. They believe that MFI or NGO funds are expensive and that the repayment terms are not favorable.

1.5.5 Surveys of Other Sector Actors

The baseline survey achieved a comprehensive coverage of other sector actors. The table below summarizes the categories of actors in the shrimp/prawn value chain. Wild PL collectors and Traders/Buying Houses were two categories not surveyed. Both are small, ancillary sectors to the main value chain and not key to SAFETI strategies, but they are included here to draw a more complete picture of the value chain. See also infographics on pages 6 and 7.

Table 11: Summary of all actors and their functions in the Shrimp/Prawn Value Chain

Actors	Functions	Roles
Broodstock Collector	Broodstock Collection	Shrimp trawlers (~30) collect shrimp broodstock from shallow inshore waters <40m in the Bay of Bengal. Freshwater prawn broodstock are collected from rivers near the ocean by local fishermen.
Hatchery	Hatching	Spawning the females, rearing larvae until they reach PL 8-14. Some hatcheries sell first stage animals called nauplii to other hatcheries.
Nauplii Hatchery	Nursing & PL trading	Nursing of nauplii up to PL stage, packaging and sale to the farmers.
Wild PL Collector	PL Collection	Some wild bagda PL are collected from the coastal areas of the southern region. Most freshwater prawn are collected by push and set nets in coastal rivers. Collection of wild PLs is illegal in Bangladesh.
PL Traders	PL Trading	Trading PL to farmers. In case of shrimp trading the PL is mostly shipped from hatcheries in Cox's Bazar. In the shrimp and prawn growing areas of Khulna most PLs are sold in a number of PL bazaars.
Farmer	Grow-out	Nursing of PL, and growing PLs up to marketable size.
Input suppliers	Supplying feed and aqua chemical	Selling readymade or locally produced feed, aqua chemicals like lime, calcium carbonate, antibiotics, medicines etc. Often a major source of technical information for farmers.
Faria/Small Collectors	Trading	Buying prawn and shrimp in small volumes from the small farmers and trading with the arats or depots. They are thought to be the main source of adulteration in the prawn chain.
Aratdars /Auction centers	Trading	Commission agents collecting shrimp from farmers/farias and selling them at auction to the collectors/depots and sometimes to processors. Take 2%-4% commission from the selling price.
Large Collectors/Farias	Trading	Buying products from the arat and selling to the processors, and agents. They usually buy in bulk volume.
Depot Collection centers	Trading, cleaning, Icing, preserving.	Bulk buying from farmers and farias and selling product to factory or processing plants through account holders/agents. They are responsible for cleaning, icing and preserving shrimp and then transporting them to plants via the account holder. All are inspected and licensed by DoF.
Account Holder /Agent	Trading	Account Holders (aka Agents) are powerful actors in post-harvest activities. 19 of them are the main purchasers of shrimp from Depots and Arats, They act as guarantors for processors ensuring supplies of shrimp on credit, maintain the transaction records for both processors and depots and take commission on shrimp supplied to the processors. They offer credit to depots who in turn offer credit to farmers, all linked to 'dadon' systems where the actors are bound to sell to their creditor.
Processors	Processing and Exporting	Collecting seafood from different sources, processing, packaging and shipping to the international markets.
Traders/Buying Houses	Trading	Post-processing aggregators of shrimp or prawn for large international purchases (>10 containers). Sourcing through processors and selling/exporting to foreign buyers.
Buyers	Trading	Foreign firms who buy shrimp/prawn from processors and others.
Trade Associations	Facilitate production and trade	Act as facilitators in the value chain.
Department of Fisheries (DoF)	Regulation, extension activity	Acts as regulator and government extension body working throughout the value chain.

In the following section a summary of the role and activities of each of the actors is presented, and of the main constraints to their operations they identified. Fuller details of these issues and the recommendations they made for SAFETI activities are included in Annex 3.

Shrimp Broodstock Collectors

Broodstock are caught by a fleet of approximately 34 shrimp trawlers operating from Cox's Bazar and sold through 10 brokers.

Most fishing reportedly takes place in shallow inshore waters of less than 40 m depth, although this is illegal.

Approximately 173,000 females are sold to hatcheries per year. Handling is poor, only smaller animals are caught in the shallower waters, and laboratory screening has shown there to be a high incidence of White Spot Virus in the broodstock that are landed, averaging over 50%.

The number of PLs produced per broodstock animal is lower than would be considered normal in other countries and is declining (from approximately 67,000 PLs/broodstock in 2009 to about 44,000 PLs in 2013), reflecting the poor quality of broodstock used and a deterioration in hatchery success.

Government regulations require only disease free broodstock to be used for production in hatcheries, and only disease screened PLs to be sold, but these regulations are not enforced. The supply of diseased seed to farmers is a major constraint to improving productivity and production in farms.

Shrimp Hatcheries

The study team visited a total of five shrimp hatcheries in Cox's Bazar (including MKA hatchery, the only hatchery in Bangladesh working with SPF broodstock) and one in Satkhira.

Apart from MKA, the Cox's Bazar hatcheries work with wild broodstock, spawning them to produce eggs, which hatch into nauplii, and they rear these nauplii for 12-15 days through 12 life stages to the post-larva stage. 5-8 days later they sell them on to farms or traders. The Satkhira hatchery buys nauplii from Cox's Bazar and rears from that point on. A diagram illustrating the shrimp hatchery sector linkages is in Annex 3 (Figure 58).

Until about three decades ago all of the shrimp farmers in Bangladesh were totally dependent on wild fry collection for stocking of post larvae (PLs); this had a serious impact on biodiversity in the coastal region.

In 1987 the Department of Fisheries (DOF with Asian Development Bank (ADB) support) established the first shrimp hatchery in Bangladesh in Cox's Bazar and in 2000, the government banned the collection of wild fry.

Presently, 43 out of 63 private shrimp hatcheries are in operation in Cox's Bazar. The major farming areas are situated in the south-west region of Bangladesh to where most of the hatchery-produced PLs are transported from the south-east region by air cargo.

Main constraints identified by the shrimp hatchery operators: inability to access High Health-SPF broodstock or nauplii, technical knowledge of staff; PL supply thought to exceed market demand; poor laboratory services support (disease/PCR screening etc.); a lack of phytoplankton seed cultures.

Prawn Hatcheries

The study team visited five golda hatcheries: two in Khulna, one in Satkhira and two in Bagerhat, and interviewed senior staff in charge of running the hatchery operations.

Broodstock are collected from local rivers and brought to the hatcheries, where all the hatching and larval rearing takes place in tanks in an enclosed environment.

The prawn hatcheries are mostly concentrated in southwest Bangladesh, close to the farming areas, mainly in Khulna, Bagerhat and Satkhira districts. A diagram illustrating the prawn hatchery sector linkages is provided in Annex 3 (Figure 57).

Main constraints identified by the prawn hatchery operators: unexplained larval mortalities that have led to closure of most Bangladesh prawn hatcheries over the last 5 years. Lack of access to disease free or SPF broodstock.

Commercial Nurseries

The study team visited a total of eight nurseries; six in Satkhira and two in Bagerhat.

Nurseries buy post-larvae from the hatcheries and rear them to a larger size, or hold them mainly just to acclimate them to local salinities before sale to farmers. Sometimes they are held for just a few days. Some nurseries hold them for 20-30 days and sell the resulting more robust animals on to farmers at a higher price.

PL traders in Khulna also often have a small nursery facility to hold PLs they were unable to sell on the day of delivery from Cox's Bazar. The nursery phase is used to offer better survival rates in the farm and buffer the flow of PLs between hatchery and farm.

Main constraints identified by the nursery operators: low demand for juveniles from farmers; lack of training on proper PL rearing and hygiene maintenance; degradation of quality of locally available water.

Input Suppliers

Ten input retailers/dealers were interviewed. They deal in feed, fertilizer and medicine.

The input retailers source feed from both international and local feed manufacturers, and of these the three major local feed manufacturers with significant market share are Paragon, Quality Feed and Mega Feed.

Shrimp feed is mostly imported from abroad by some international companies such as CP. Prawn feed demand is mostly met by local producers.

Other input products such as fertilizer and medicines are also available in the input retailer shops.

Local dealers are a principal source of technical information for farmers, but their own technical knowledge is limited and the advice they offer can be incorrect.

Main constraints identified by input suppliers: lack of training for farmers on feed management practices, pond preparation, chemical usage and disease management; no specialized credit scheme for shrimp feed and input supply businesses; limited support from government extension bodies and research institutes to prevent frequent disease losses; limited technical knowledge to support their advisory role to farmers.

Local Feed Manufacturers

Most of the shrimp feed used in Bangladesh is imported from India, the Philippines and Taiwan by companies including CP, Gold Coin and President.

Local feed manufacturers are reluctant to produce shrimp feed due to the small size of the market (less than 10,000 MT per year) and because it is already dominated by imported feeds. However, local feed manufacturers are producing prawn feed and are considering the production of shrimp feed in the future.

The study team met with senior management of Mega Feed Limited and Quality Feed Limited, two major feed manufacturers and distributors operating in Bangladesh. Each has 900 dealers and sub-dealers country wide. Mega Feed sales volumes last year were 120,000 mt of fish feed and 3000 mt of golda feed. Quality Feed sold 150,000 mt of fish feed and 10,000 mt of golda feed. Both have well qualified technical experts supporting their formulations and manufacturing process.

Main constraints identified by the feed manufacturers: the local market for shrimp feeds (<10,000 t) is currently too small to justify large scale investment in production; the minimum protein requirement set by GoB for golda feeds is unhelpful; there are problems importing key ingredients.

Faria/Small Traders and Faria/Large Traders ("Collectors")

The study team interviewed eight farias/small traders, dealing with shrimp and prawn: three farias in Jessore, two in Satkhira and one each in Khulna, Bagerhat and Cox's Bazar.

In Bangladesh, faria is a Bangla term for a kind of small trader or aggregator who procures shrimp from farmers at harvest or from local markets. He then sells to depots (collection centers) or arats (auction centers).

In the field work, it was also noted that there is another group of larger scale faria who buy from the auction market and then transport to the processors, or via agents of the processors. To avoid confusion, these larger scale operators will be referred to as "collectors" in this report.

Farias and "collectors" are usually active in trading shrimp and prawn for 7-8 months of year when both are being harvested. They also trade in fish throughout the year.

Main constraints identified: little knowledge on Good Handling Practice and the quality requirements of factories and international buyers; allegations that farias are involved in malpractices to increase shrimp/prawn weight (such as 'pushing' [injecting gelatin] and soaking in ice-water).

Aratdars and Arats/Auction Centers

The study team interviewed a total of seven aratdars for the study. Among the seven, two aratdars each were interviewed from Satkhira and Jessore and one each from Khulna, Bagerhat and Cox's Bazar.

Aratdar is a Bangla term for a commission agent who provides auction space, loading, unloading and packing services for sellers. The aratdar acts as the bridging agent between various actors, in exchange for a commission. The practice of auctioning shrimp and prawn is relatively new, although it is widely practised for trading of other types of fisheries products such as finfish and catfish as well as other agriculture products. Previously, depot holders and farias were the main middlemen who procured the fish from farmers and supplied it to the processors.

Across the study area, it was found that aratdars source shrimp/prawn from both farmers and farias with the majority of the product coming directly from farmers.

More than 80% of the farmers and farias bring the shrimp/prawn without ice and almost all of the farmers transport shrimp/prawn in plastic bags or plastic crates (often customized crates made from plastic drums). Nowadays farmers have limited the use of bamboo baskets. Aratdars stated that the shrimp/prawn are usually brought within 1-2 hours after harvest.

Main constraints identified by the farias: lack of product supply; poor roads; lack of good quality ice; inadequate knowledge of Good Handling Practice (GHP) - Arats discouraging farmers from using ice; lack of access to appropriate financial products.

Depots

The study team visited a total of 10 depots spread across five districts. Out of the 10, three depots were located in Khulna and two each in Jessore, Satkhira and Cox's Bazar and one depot in Bagerhat.

In the shrimp and prawn value chain, depot holders are middlemen who have their own establishments and staff located in market localities near the farmers.

Depots are a major feature of the shrimp producing areas of Bangladesh. They are the key middle functionary between farmers and account holders or processing plants. There are mandatory specifications for depot construction and operations, and based on the adherence to these regulations, the establishments are licensed by the Fish Inspection and Quality Control (FIQC) of the Department of Fisheries (DoF). However, based on the observations made by the team, there are some depots that are functioning without a license. A diagram illustrating the depot linkages is provided in Annex 3 (Figure 68).

Out of the 10 depot holders interviewed, three were small, trading about 18-25 metric tons of product annually. The others reported trading around 125 metric tons annually. In both cases, the respondents observe peak and off-peak seasons for the supply of their respective products (shrimps or prawns).

Main constraints identified by the depots: lack of product supply; delay in payments by account holders; employees do not have training on FIQC and how to ensure quality standards; ice plants in some locations cannot supply enough ice during peak seasons; and, like arats, depots discourage upstream suppliers from using ice.

Account holders/Agents

The study team interviewed six account holders, the majority in Khulna and the rest from Satkhira and Cox's Bazar.

Account holders, also known as agents, are major actors in the shrimp value chain, with a role as mediator and financer. Usually shrimp or frozen food processors work with a number of account holders through whom depots, farias, or farmers supply their products and payments are transacted.

Account holders are not the owner of the products, but they take commission from the sales value. They are responsible for many of the financial transactions among the market actors. This business is highly liquid-capital intensive as account holders purchase products from their suppliers, mostly in cash and sell to the processing plants or exporters on credit. The current account holding system makes the value chain longer and more complicated, but is helpful to processors in terms of financing their businesses.

Five of the six account holders interviewed trade annually about 3,000 mt shrimps and prawns, while the sixth, based in Khulna, handles 1700 mt per year. Turnover of each ranges from BDT 100 million (USD 1.2 million) to 1,500 million (USD 18 million) worth of products per year. The commission varies from processor to processor, but last year it was around BDT 300 per 40 kg shrimp.

Main constraints identified by the account holders: lack of product supply; cashflow; adulteration of products upstream

Processors

The study team interviewed senior management staff from five processing plants, two of which were in Khulna, and one each in Jessore, Satkhira and Cox's Bazar. A diagram illustrating the processing plant linkages is provided in Annex 3 (Figure 71).

Processors strive to adhere to quality requirements for export, but the shortage of product in the face of export targets sometimes forces them to be lax in screening incoming raw material.

Capacity utilization of those interviewed was in the range 30-40%, which is higher than average for Bangladesh. Installed capacity ranged 5,500-8,000 MT per year.

The processors are frustrated about the lack of product and the difficulty in sourcing sufficient and good quality raw materials (shrimp and prawn) in order to fully utilize their processing capacity.

Main constraints identified by the processors: lack of product supply; cash flow; adulteration upstream; lack of qualified technical staff

Trade Associations

Two trade associations were interviewed – the Bangladesh Frozen Food Exporters' Association (BFFEA) and the Shrimp PL Trader Association - Satkhira.

Bangladesh Frozen Food Exporters' Association (BFFEA)

The study team interviewed the Vice President of the BFFEA, who made the following observations:

- Bangladeshi shrimp and prawn compete mainly on price, not on quality.
- The cold chain is not fully maintained while shrimp/prawn is being transported from farmers' ponds to the processing plants.
- BFFEA lacks the power and manpower capacity to enforce rules /regulations on individuals or business entities. A stronger market monitoring and advocacy unit will be valuable to improve the whole system. It could be done in partnership with BFFEA, DoF and in collaboration with national/international development organizations.
- Traceability is very important in order to participate in the EU shrimp market. Unfortunately, due to the industry being mainly small-scale, extensive farms it is difficult to ensure full traceability. Group formation might help since farmers will most likely be engaged in collective purchase of inputs such as PL, feed, medicine from a single source and sales will be collective to a few buyers who prioritize traceability.
- Market access in the retail segment is very crucial. Certifications like BAP, Global G.A.P., or Aquaculture Stewardship Council (ASC) are needed. Since most farms are small scale extensive, certification is not common. The problem is both technical and financial and buyers are generally not willing to pay a sufficient premium for certification.

Main constraints identified by the BFFEA: low productivity at farmer level; lack of traceability due to small scale of farming; lack of continuous cold chain during transport and storage; malpractice such as 'pushing' and soaking.

Trade Associations: Shrimp PL Traders Association-Satkhira

The study team interviewed a member of the PL Traders Association in Satkhira. He listed PL quality as a major concern; the PL available in the market is of low quality and prone to diseases. Hatcheries report that they are selling PLs at a loss, as the PL price is relatively low this year. This discourages the hatcheries from producing better quality PLs.

The respondent also mentioned that the shrimp/prawn value chain is quite complex and many actors lack market information. He mentioned that marketing policy at each step of the prawn value chain is very weak. In discussions about the PL disease testing facilities, he highlighted their unavailability.

Regarding diseases, government labs or testing facilities are not always up to standard and they are also slow to respond and diagnose. According to him, the Department of Fisheries is not monitoring the PL market properly to prevent low quality PL from entering the market.

Suggestions and strategies to address the challenges included establishment of PCR testing labs., as well as ensuring easy access to the labs. for small and marginal farmers. The respondent also mentioned that development projects could provide the Association with PCR testing kits.

Main constraints identified by the PL Traders Association: quality of PL and concerns about disease; low price of PL discourages hatcheries from striving for quality improvement; lack of PL testing facilities before marketing; low awareness about disease prevention; Government research and testing facilities not able to provide effective and prompt support; lax monitoring allows low quality PL to enter the market.

Buyers/Buyer Representatives

The study team interviewed two buyers for overseas companies, one handling purchases for Eastern Fish Co. LLC, Blue Sea Product LLC, and Lawrence Wholesale, all of the USA; and the other buying for Belgian company Pierre Hottlet (who also supply Anduronda GmBH of Germany).

They observed that Bangladeshi shrimp and prawn are inherently of good quality since most farmers grow in extensive farming systems with low use of feed and other chemicals. However, the quality deteriorates after harvest as the product is transported through multiple actors to the processors.

They also mentioned that Bangladeshi shrimp and prawn are much tastier than their main competitor, *vannamei* shrimp cultivated by India, Thailand and Vietnam. However, those countries are enjoying a comparative advantage in terms of price. *Vannamei* is cheaper than black tiger shrimp. Overall exports have shown a decreasing trend in the last 3 years.

Main constraints identified by the buyers: low productivity; cold chain not maintained at all times leading to quality deterioration; malpractice still prevalent in the value chain (‘pushing’, soaking) but less than before- overseas buyers react negatively when malpractice found - including discontinuation of purchasing; Bangladeshi shrimp/prawn losing out to price competition from white shrimp (*P. vannamei*) in the international market.

Department of Fisheries

The study team interviewed Department of Fisheries (DoF) officials from all 5 project districts.

DoF have 4 shrimp training-cum-demonstration farms in Khulna and Cox’s Bazar region and 6 prawn training centers are under construction. Furthermore, 23 small scale shrimp/prawn hatcheries have been established for demonstration and training purposes.

DoF has also carried out the following activities:

1. Implementation of 11 shrimp and prawn development projects funded by GoB and donors.

2. Implementation and monitoring of legislation with regards to the establishment of shrimp and prawn hatcheries.
3. Farm registration, export market and processing.
4. Licensing of landing stations, auction centers, arats, depots, feed mills and ingredient sellers etc. under the Acts and Regulations for FIQC.
5. Fisheries conservation (a ban on Pl collection and seasonal trawling restrictions).
6. Requirement for PCR testing of all broodstock and PLs.
7. Conducting motivational activities and awareness building programs with farmers, and other value chain stake holders, as part of their extension activities.
8. Facilitating several training programs in partnership with development partners and NGOs.
9. Introducing improved aquaculture technologies through training and demonstration.
10. Inspection, testing and certification for exported fisheries product and imports related to aquaculture production.
11. Operation of demonstration farms and training centers established under development projects.
12. Maintaining liaison and cooperation with other nation building organizations like BWDB and others for shrimp polder development.

Main constraints identified by the DoF: poor knowledge by farmers of shrimp/prawn culture practice, lack of modern technologies on feed, water and nutrition management; poor farm infrastructure in extensive farms - inadequate water depth, water supply and drainage systems are poor and often silted up; value chain with too many middlemen and actors; mis-use of chemicals and medicines in hatcheries and in farm production; weak cold chain maintenance throughout the value chain; malpractice by some middlemen to increase weight of shrimp and prawn; outbreak of viral, bacterial diseases at different stages of production; many DoF positions in shrimp/prawn producing areas are vacant; insufficient technical human resources; insufficient logistic and testing equipment at DoF field offices; weak cooperation and contact among the public and private actors involved with shrimp/prawn sector development.

1.6 Recommendations on Changes to Project Activities as a Result of the Baseline Study Findings

SAFETI has 11 planned activities:

Activity 1: Inputs: Develop agro-dealers and/or other input suppliers
Activity 2: Financial Services: Facilitate agricultural lending
Activity 3: Training: Improved agricultural production technologies
Activity 4: Capacity Building: Government Institutions
Activity 5: Capacity Building: Promote improved policy and regulatory framework
Activity 6: Training & Facilitation: Sanitary and phytosanitary standards
Activity 7: Training: Post-harvest Handling
Activity 8: Infrastructure: Post-harvest Handling and Storage
Activity 9: Training: Improved Marketing and Branding
Activity 10: Market Access: Facilitate Buyer-Seller Relationships
Activity 11: Capacity Building: Trade Associations

The baseline findings emphasize the prime importance of Activities 1, 2 and 3: supply of clean disease-free seed (included in Activity 1), improved pond infrastructure and production technologies (Activity 3) and the finance to fund the changes (Activity 2). These three are identified as key to promoting an increase in productivity, production and exports. Activities 4 through 11 are similarly confirmed as appropriate to address the aims of Objective 2: in particular to expand trade, improve post-harvest handling and build the capacity of trade associations and government.

The baseline findings suggest the following two activities should however be modified:

Activity 1: Inputs: Develop Agro-Dealers and/or Other Input Suppliers
Activity 1 envisaged work not only on seed and other inputs (which remain important) but also work on feed: the Work Plan approved January 2017 proposed that because "*National feeds currently are of poor quality, including regarding formulation and physical properties"* the project would *"provide technical assistance to leading Bangladesh feed mills on feed formulation and manufacturing ..."*

The baseline survey has established that national feed manufacturers are producing golda (prawn) and fish feeds of acceptable quality, and that the current market for bagda (shrimp) feeds is being well supplied by imports – national manufacturers see the shrimp feed market as currently being too small for them to enter the business in competition with imported feeds. Access to good quality feed is thus not currently a constraint in Bangladesh. It is proposed therefore that the project does not proceed with *"provid(ing) technical assistance to leading Bangladesh feed mills on feed formulation and manufacturing ..."* and that we cut the activities:

- *1.16 Conduct detailed chemical/nutritional analysis of feeds currently available on the local market;*
- *1.17 Conduct Technical Needs Assessment (TNA) of feed manufacturers;*
- *1.18 Carry out economic analysis and evaluation of inputs for small-scale feed production;*
- *1.19 Based on the TNA, identify and support cooperating feed mills: on how to upgrade systems and feed quality and support more efficient production of higher quality shrimp and prawn feeds;*
- *1.20 Encourage the use of soy and soy products including Soya Protein Concentrate to reduce the amount of fish meal and oil in shrimp and other aquatic animal diets;*
- *1.22 ...provide technical support to selected feed manufacturers in formulation and processing...*

Activity 8: Infrastructure: Post-harvest Handling and Storage
The Work Plan approved January 2017 proposed that "*SAFETI will embed improved cold chain equipment at critical collection centers and marketing junctions of targeted value chains through the use of improved aggregation depots and methods and procedures in establishing cold chain; and depending on budget availability, by upgrading cold chain equipment at selected depots, landing centers, and auction sites along the aquaculture value chain.*

SAFETI will promote linkages to credit for co-investment and credit options. Cold chain infrastructure will be promoted using a three-pronged approach that will increase understanding of the purpose of cold chains, identify appropriate innovative technologies, and introduce to beneficiaries cost-benefit analysis."

The baseline study has established that there is considerable overcapacity in the processing sector and no immediate shortage of refrigeration and product handling infrastructure or equipment. It is therefore proposed that this activity be reduced to provision of small-scale equipment such as insulated boxes and handling equipment to direct project beneficiaries.

1.7 Proposed Areas of Emphasis in Influencing a Re-structuring of the Value Chain

The main areas will be addressed: promotion of a shift from the use of wild broodstock to the use of domesticated disease-free animals; improved culture practices, improved infrastructure (and access to finance) and, shortening the post-harvest chain between farmers and processors.

1.8 Baseline data and Performance Monitoring Plan Indicators

One of the key objectives of the baseline study was to gather baseline data of the shrimp and prawn farmers, and other actors along the value chain, which will be used to help refine targets and set the foundation for bi-annual performance assessments and reporting, and for assessing project outcomes and impacts through the midterm and final evaluations. The baseline study has provided key information on farmers' current practices, productivity and challenges against which the project impact can be measured.

Most of the project indicators assess changes from a zero-starting point and specific baseline data will be collected of the project beneficiaries once target groups are finalized, but the baseline study data will contribute to the following SAFETI Performance Monitoring Plan (PMP) outcome indicators:

Table 12: SAFETI Performance Monitoring Plan (PMP) outcome indicators to which the baseline survey will contribute

Outcome Indicators	PMP LOP Target
FFPr SI-2: Number of individuals who have applied new techniques or technologies as a result of USDA assistance	20,200
FFPr SI-7: Number of private enterprises, producer organizations, water user associations, women's groups, trade & business associations, & community-based organizations (CBO) that applied improved techniques and technologies as a result of USDA assistance	1,760
FFPr SI-13: Value of sales by project beneficiaries	$6,550,000
FFPr SI-14: Volume of commodities (metric tons) sold by project beneficiaries	TBD
Custom Indicator 1: Improved production per ha (by direct project farmers)	500 kg/ha

The baseline study established baseline values for indicators for which data were previously not available, as follows:

Table 13: Baseline values established by the study for non-zero SAFETI PMP indicators

Indicator No. & Label	Definition and Unit of Measure for baseline value	Baseline Value		Total
		Shrimp	Prawn	
FFPr SI-13: Value of sales by project beneficiaries	**Definition:** Measures total value of sales of shrimp and prawn in the past year by all farmers (396) surveyed and included in the baseline study (298 shrimp farmers, 98 prawn farmers). (US Dollars)	USD 1,778,601	USD 194,924	USD 1,973,525
FFPr SI-14: Volume of commodities (metric tons) sold by project beneficiaries	**Definition:** Measures volume in gross metric tons of sales of shrimp and prawn in the past year by all farmers (396) surveyed and included in the baseline study. It includes the volume of all shrimp and prawn produced in the past year, not just the volume of farm-gate sales. (metric tonnes)	229.2 mt	29.4 mt	258.7 mt
Custom Indicator 1: Improved production per ha	**Definition**: Measures the average production of shrimp and prawn per ha of the farmers (396) surveyed and	Khulna 342 kg/ha Bagerhat 260 kg/ha Satkhira 309 kg/ha	Khulna 345 kg/ha Bagerhat 362 kg/ha Jessore 253 kg/ha Satkhira 180 kg/ha	-

	included in the baseline study. It includes the volume of all shrimp and prawn produced per ha in the past year, including domestic consumption and not just the volume of farm-gate sales. (kg/ha)	Cox's Bazar 66 kg/ha		
Custom Indicator 2: Increased sales of Specific Pathogen Free (SPF) and Polymerase Chain Reaction (PCR)-screened PLs by hatcheries	**Definition**: To ensure better production and quality of commodities (shrimp and prawn), SAFETI will promote the production and sales of SPF and PCR-screened PL. To track this information, sales information from partner hatcheries will be collected on SPF and PCR screened PLs (number of PLs sold)	PCR-screened PL: accurate data for total PCR-screened PL is not available, but for the interviewed hatcheries (except MKA) accumulated sales were 2 billion SPF: 150 million by 1 Hatchery (MKA)		

1.9 Recommendations on Changes to Project Indicators as a Result of the Baseline Study Findings

In the light of the baseline study findings there is no need for increased cold storage capacity (see paragraph above) it is recommended *Indicator 6; FFPr Sl-11 Total increase in installed storage capacity (dry or cold storage) as a result of USDA assistance* - which sets a target of 1,612 cu.m. be deleted.

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Abdullah Al Shakib

Study Team Leader

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